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CONTENTS

3 **BALLOONING IN THE STRATOSPHERE**
Major General Orvil A. Anderson, USAF (Ret)

15 **HALF A CENTURY OF AIR POWER**
Sir John Slessor
Marshal of the Royal Air Force

25 **THE MEN AND THE MACHINES (Part II)**
January 1915—April 1916
A Chronological Treatise on the Growth of Air Power

34 **MILITARY AIRCRAFT AND THEIR USE IN WARFARE**
Major General Mason M. Patrick
Chief, U. S. Army Air Service, 1921–27

40 **A WAR DIARY (Part II)**
Lieutenant Roland R. Birnn

46 **NEWS ITEMS**

48 **RECOMMENDED READING**

It is the policy of *The Air Power Historian* neither to endorse nor subscribe to the views expressed in the articles it presents. Many events in history must perforce remain controversial by reason of the multiplicity of interpretations given these events by those who participated in them, or have studied them from hindsight.

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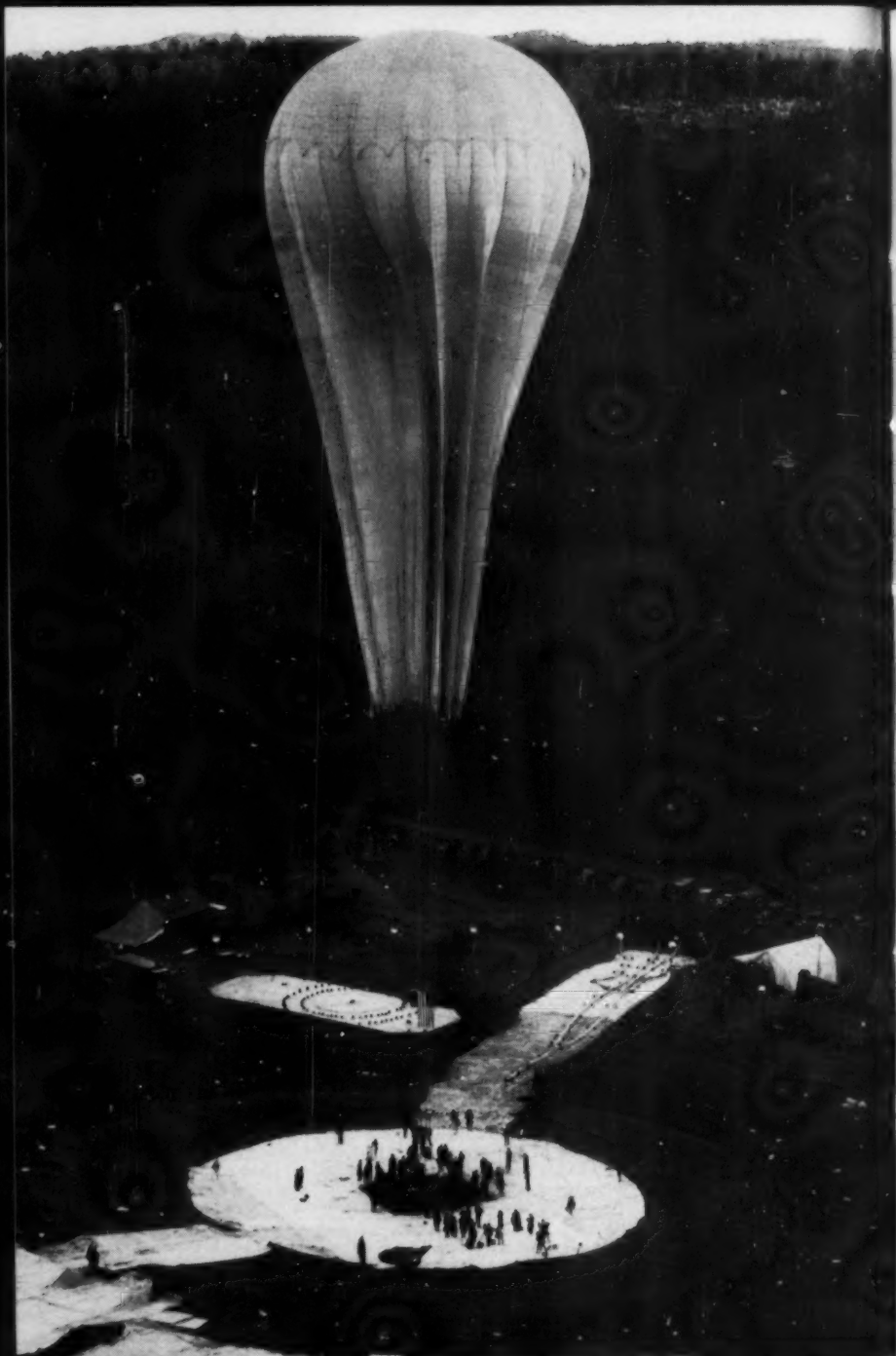

Explorer I—Ready for Flight (1934)

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BALLOONING in the *Stratosphere*

By MAJOR GENERAL ORVIL A. ANDERSON (*Ret*)

Whenever man enters an exploratory field he instinctively responds to a natural impulse and leans on past experience to guide him as far as it can. While profit can always be gained from experience if it be kept within realistic bounds, if it be resorted to as a substitute for solution of new problems which, because of new or changed factor values, find no counterpart in past experience, resort to this substitute for analytic solution can, and too frequently does, expand both hazard and cost. This observation is clearly supported in man's efforts to explore the stratosphere.

These exploratory ventures were initiated in 1862. In that year two British balloon pilots, Glaisher and Coxwell, reached an altitude of 37,000 feet. At this altitude, for this latitude, they were in the fringe of the stratosphere. (The tropopause, which divides the troposphere from the stratosphere varies with latitudes,—approximately 52,000 feet at the Equator, 37,000 feet at 45° Latitude, and 16,000-19,000 feet at the Poles.) They took oxygen along but the quantity was insufficient to maintain physical and mental stamina. They slumped to the bottom of the basket because of oxygen deficiency but Coxwell was able to get a clamp, with his teeth, on the valve cord, open the valve and bring them safely back to earth. Their hands were, also, numb from the low temperatures experienced at this altitude. The flight was made in an open basket. A timely provision of warmer clothing and more oxygen would have made that initial penetration of the stratosphere much more comfortable and entertaining while, at the same time, reducing the hazard.

The next recorded expedition into the stratosphere was made in 1927 by Captain Hawthorne C. Grey of the Army Air Corps. He had the experience of Glaisher and Coxwell to guide him. Major advances had been made in equipment for this flight,—a bigger and better balloon, an electrically heated flying suit and an oxygen mask with manual control for the supply of this vital life-sustaining component of atmosphere.

But Captain Grey had left a door ajar for an operational error which, if committed, could only mean disaster. He had arranged a battery of oxygen cylinders to supply his needs. They were used singly in sequence. As each cylinder was emptied it was cut free and dropped as ballast, giving an additional altitude of about 200 feet. He was in radio communication with the ground and encountering no operational difficulties until he cut into his last oxygen cylinder and dropped the one he had presumably just emptied. Shortly thereafter communication with Captain Grey came to an abrupt ending. The indications are convincing that, in his last act, he dropped the full cylinder and kept the empty, and shortly went unconscious. The balloon remained at altitude until a decreasing gas temperature caused it to settle to the ground. I, who was flying a contact airplane, was on hand at the landing: the life of Cap-

tain Grey had left sometime before that landing. He had reached an altitude of 44,300 feet.

The third pioneer to enter the stratosphere was a Belgian scientist, Dr. Auguste Piccard. It may have been to his advantage that he was not a balloon pilot. Not being victim to dictating precedent, he built a balloon bag of sounder design which served him well in both his landings. The significant change was in leaving the bottom of the bag open. While this did not lend to precision control, it did reduce the chance of a crash landing. In descent the open bottom permitted air to flow into the bag. While the sun was shining this trapped air would rise in temperature and give additional lift. This cushioned the rate of descent and landing. It was a simple and safe substitute for pilot skill.

Dr. Piccard also designed and pioneered the use of a pressurized cabin. In this closed gondola he maintained the desired pressure and oxygen content during his tour in the upper atmosphere.

However, he too experienced difficulties in actual flight. On his first expedition (27 May, 1931) he allowed too little slack in his valve cord and, as the bag expanded, the control cord broke. This forced him to remain at altitude until the descending sun allowed the lifting gas to cool a little and thereby lose some of its bouyancy. The sun's heat controlled his rate of descent but because of his foresight in providing an open bottom bag, he settled back to earth at a cushioned rate of descent, with only a very tolerable shock at impact. He reached an altitude of 51,775 feet.

On his second flight on 18 August, 1932, he had corrected the cause of his valve cord failure in his previous venture. He reached a maximum altitude of 53,152 feet. He descended in control of his rate of fall but not of his drift. He landed on a glacier in the Alps and, in his words, had many more thrills and difficulties getting from that glacier back to civilization than in getting his balloon back to earth.

The success of Piccard seemed to trigger broader interest and stratosphere ballooning became a popular venture. The following month a Russian aeronaut reached a reported altitude of 60,695 feet and landed safely. Typical of Soviet restrictions, the details of that flight and the scientific data that it gathered were never released.

This same year the Chicago World's Fair sponsored another stratosphere venture. It was piloted by Lt. Commander Settle of the United States Navy with Major Fordney of the Marines doing duty as observer. In their first attempt they left the ground with a leaking valve. This faulty valve action caused a rapid loss in lift and forced them to stop at 5,000 feet and make a hasty return to earth. With the repair of the damaged gondola a second flight was launched from Akron, Ohio. On this flight they set a World's altitude record of 61,237 feet. Unfortunately, on their way up, they suffered the same mishap that Professor Piccard experienced in his initial venture,—the valve cord tore loose from its attachment to the gondola and left them with no control to start the balloon back down. They, too, had to sit at their ceiling and wait for a kindly sun to reduce its heat radiation and start them back toward earth. Meanwhile they were drifting at a disturbing rate toward the vast water expanses of the Atlantic Ocean, a very poor and dangerous landing surface for a stratosphere balloon.

When, in the late afternoon, they

finally started down they were still over land, but were dangerously close to the Atlantic shore line. Facing this predicament Commander Settle let the balloon accelerate in its fall until he knew he could land short of the shore line. He then decelerated its rate of fall by jettisoning all of his disposable ballast and equipment and effected a successful landing in the eastern marshes of Delaware Bay. All in all it must have been a rather thrilling and profitable experience.

The Settle balloon was built to orthodox patterns. The bottom was closed with a sleeve vent to allow the escape of excess volume as the gas expanded but, also, to insure that no air would enter the balloon as the gas contracted. As the balloon descended into ever-increasing density of air, as it approached the earth's surface,—responding to natural laws.—the volume decreased and the balloon contracted. A reduction in excess temperature of the gas over that of the surrounding atmosphere produced a similar reaction. That excess temperature is always greater where the air is lightest,—at the ceiling. As a balloon descends into denser air it gets increased shielding from the sun's heat radiation while, concurrently, that denser air provides a more effective medium for reradiation of that excess gas temperature. It is this reduction in excess heat (commonly termed superheat) that produces loss in static lift. It is to meet this decrease in lift, as the balloon approaches the earth, that ballast must be discharged to maintain static control and effect a successful landing. If the bottom of the balloon be left open, the entry of air into the bag will tend to keep the balloon fully inflated; the trapped air will become superheated and, if the sun is shining on the bag, will far more than counterbalance the loss in lift suffered by the contracting gas.—and a cushion is thereby provided for coming back to earth.

The Settle experience produced a contradiction in values. Having lost control of his gas-releasing valve he was trapped at the ceiling until the sun's heat reduced sufficiently to start him down. He was then closing in on the Atlantic shore line. With the closed balloon he lost lift much faster and arrived at the ground much sooner than would have been the case if the bottom of his balloon had been open. But this value relates to a critical limitation in operational control through the loss of his valve line. Had he retained control of his gas valve, and had an open bottom balloon, he could have gone much higher much safer. He could have expended his ballast to gain greater height and return to earth on a superheated air cushion.

In early 1934 three Russians (Fedesienko, pilot) made a second Russian attempt to explore the stratosphere. It was a very well organized operation and great care had been taken to forestall former accidents. In the biggest balloon ever built (800,000 cu. ft.) they rose to a reported altitude of 72,000 feet. To get there they expended all their ballast and, thereby, sealed their doom. They were flying in a closed balloon which demanded considerable reserve ballast if they were to return to earth in control of their craft. That balloon returned to earth in an ever-accelerating rate of fall. Somewhere in that descent the bag collapsed and they made the rest of the journey as a free-falling body. They presumably had no individual parachutes, as none survived. Their last report was made, as they were entering the troposphere, with the information that they had lost control.

If these men had ridden this same

balloon with the provision of an open bottom the possibility is strong that they would have returned to earth safely, and in control. They had no chance to do this, after all their ballast had been expended, when the bottom of their balloon was sealed.

This was the background of experience available to the National Geographic-Army Air Corps Stratosphere expedition. This expedition was conceived by Captain A. W. Stevens,—a man who had never developed the art of responding to 'can'ts.' He never believed because man had previously conducted a somewhat similar operation in a certain manner with seeming success that that established the right way, or even a superior way, to do it. He recognized, to a healthy degree, the limitations of experience as a teacher. He was a valuable man to have around when most of the problems confronting the expedition had so many original features. But, able as he was, he couldn't knock down all the barriers that were deeply rooted in established values.

By any yardstick of that time the expedition was a bold one that could only be supported by optimistic minds. The sixty-three research studies scheduled,—most of them scientific in features,—required a laboratory weighing in excess of 3,000 pounds. To get this laboratory to the predetermined altitude of 70,000 feet demanded a balloon having a capacity of 3,000,000 cubic feet of hydrogen gas,—five times larger than anything previously built and successfully flown. The dictating purpose of this expedition was to float a scientific laboratory above 70,000 feet for research and observation. The altitude which, if reached, would set a record was secondary to that objective. Here I confess that it had been my continuing hope that on the third of a series of flights we could remove its shackles and let the balloon ascend to its optimum ceiling,—which should have been in excess of 85,000 feet. To accomplish this objective the laboratory had to be made expendable as ballast, the bottom of the bag had to be opened, and the balloon operated so that it would pass its static ceiling while still ascending at approximately 1,000 feet or more, per minute. This would give an additional few thousand feet without increase in hazard. Such a flight was never flown.

Following the limited success of our third venture our sponsors responded to the adage, "leave well enough alone,"—and our stratopheric operations were ended.

At the time the project was approved Major W. E. Kepner (now Lieut. General, Ret.) was assigned as commander of the expedition and pilot of the balloon. Stevens took over the task of scientific coordinator during the preparatory phase and scientific observer in flight,—he was to operate all the scientific gadgets. I was assigned as operations officer. My major task was to inflate and rig the balloon for flight and then launch it,—an operation in which I had no related experience to guide me.

When inflated and rigged for flight the top of the balloon would be 310 feet above the ground. Most of the fabric would be hanging limply from a small bubble of gas at the crown. In this condition it was supervulnerable to even the mildest wind. A shelter was demanded that would insure calm air during the inflation process. As no man-made structure could house it, we had to find that protection in a shelter nature had provided. After an extended reconnaissance we found such a shelter in the Black Hills of South Dakota. This bowl fills in the later afternoon with relatively cold and, therefore, heavy air, and remains per-

Final Separation of Lower Section (In Descent)

fectly calm between the hours of sunset and sunrise in winds up to 15 miles per hour unless a front be passing. It was a perfect site for inflation.

Another meteorological need was a certain forecast that the area over which the balloon would drift during flight would remain cloudless. Three such forecasts were made,—in none of them did a cloud appear in the projected flight path. After the balloon had reached its maximum altitude and was in descent, the shadow of clouds would have forced a crash landing.

On July 10th an acceptable forecast arrived. That night the balloon was inflated and rigged for flight. Nothing occurred to interrupt the schedule and the air remained completely calm. It was a very propitious launching. As a product of improvisation, I went along as co-pilot.

We operated to a preplanned schedule until we began leveling off to stop for a final check-up at 60,000 feet. At this altitude the bottom of the bag, which had been folded up inside the upper section, began to make its appearance. It was not a comforting sight: numerous tears were present in this now unfolding fabric, and we didn't know how they had developed, —because we weren't thinking too well. There was an obvious explanation, but we didn't reach it at that time. They could only have been caused by excess local tensions as the bag unfolded. And these local excess tensions had to be the result of sticking fabric. But whether we saw the cause or not, we should have found almost immediate mental comfort from the fact that all these visible tears were below the reinforced catenary band, and it was impossible to conceive how one of these tears could break through that barrier and go above. If they stayed below, and they did, we were not in danger. All of these observa-

tions came to mind after, not before, we had landed. Our thinking potential must have been, under the impact of fear, a little low.

These were all secondary factors. With the loss of the bottom of our balloon as a container of lifting gas, our objective was automatically cancelled. Getting back to earth, or getting back to an altitude from which we could take our individual parachutes and live, became our immediate and impelling objective.

In descent the balloon responded normally to controls. We maintained a rate of 600 feet per minute. However, even this slow speed put tensions and continuously enlarged the dimensions of the tears. Finally in one surging motion the entire lower portion of the bag tore free just below the catenary band, and settled down over the gondola.

This was a propitious event. The balloon now almost fully inflated served both as a balloon and, also, as a parachute, and I, for one, felt that our troubles were over,—but they were not.

At 20,000 feet we opened the gondola and then discussed the advisability of taking to our chutes; I dissented. On the way up Steve had inadvertently opened my chute and it was, at this time, just a pile of silk lying on the floor of the gondola. I did not relish testing a chute in that condition. I did, however, drape the loose silk over my left arm to meet any emergency that might force me to do it.

That emergency was not long in coming. As we were leveling off for the final approach to a landing, the bag exploded. With the explosion I left,—and the unpacked chute worked very well. Both Bill and Steve, while they took a little longer, got off in time,—just in time. They were within

Explosion—End of First Venture

500 feet of the ground as their chutes came open. I, from a bleacher seat above them, watched the grand finale of that show.

The cause of this explosion, as determined by a scientific board of investigation, was a static spark, from an unknown source, in an explosive mixture of hydrogen and oxygen within the bag. This explosive mixture was reached through mixing the trapped air with hydrogen gas. Hydrogen is the lightest and most efficient of all lifting gases but, when mixed with oxygen, it becomes progressively inflamable and then explosive. But whenever hydrogen fails some related failure is always the triggering cause. Piccard never put that contributing flaw into either of his stratospheric ventures. Both were open bottom balloons and both, in the descent, mixed hydrogen with air, but neither exploded as a result of that mixing,—and his landings were successful.

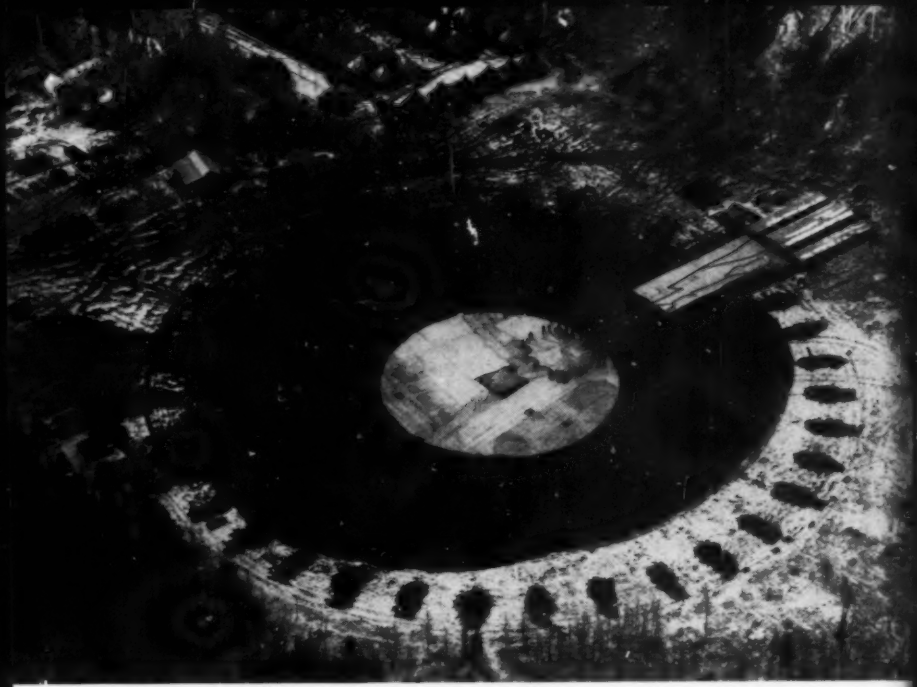
Hindsight disclosed that our method of folding the bottom of the bag into the upper section, to have it out of the way during inflation, was both dangerous and unsound. A better comprehension could have discovered this flaw from the vantage point of foresight. This experience did not disclose a structural flaw that was tailored into the bag,—a flaw that had the firm support of experience and established value. This, too, was later to become exposed through hindsight.

For our next attempt we substituted helium as the lifting gas. With this inert, but heavier gas, we had to enlarge the bag to 3,700,000 cu. ft. capacity in order to carry out the original objective.

In July of 1934 an acceptable weather forecast developed. That night we inflated the balloon under ideal weather conditions. We were completing our final pre-flight inspection when, without warning, the top of the bag blew off,—a very fortunate and timely exposure of another flaw. With the fabric on hand and available for detailed inspection the flaw came into the open.

Throughout the history of free ballooning it had always been standard practice to tailor a slit in the crown of the bag, reinforce its edges and then tape a closing panel over that opening which could readily be torn free through the application of an attached ripping cord. This was to provide rapid deflation of the bag at landing while confining the opening to the dimensions of the reinforced panel. In the smaller balloons of heavier two and three-ply fabric the localization of stresses at this reinforced panel remained well within structural tolerance limits. But when we tailored a bag, far greater in dimensions, with the lightest fabric that we dared to use a concentration of stresses at this reinforced and, therefore, less elastic panel exceeded the elastic limits of the local fabric and it failed at a point of juncture with that panel,—and the top of the balloon went with that failure. This flaw could have been detected in laboratory tests at much less cost and hazard. But we didn't think that necessary;—it had such seemingly firm support in experience.

Following this mishap there was much discussing and panel testing under laboratory conditions. The designers were reluctant to divorce the panel; they preferred to improve it by giving a greater area spread to the reinforced panel. The crew stood firm for removing the panel and replacing it with a wire cutter that would merely start a tear. We believed firmly that if we started a tear in the crown of the bag that tear would immediately expand and decapitate the bag. We



Explorer II—Unfolding Bag for Inflation (1935)

At Take-Off

Inflation in Progress

Going Up (Over South Dakota)

had a very fresh experience to support our views. We had only recently seen the top of this same bag blow off from a similar triggering course. Our views prevailed and the panel was discarded.

With our newly tailored bag, less two of the original flaws, we were ready for another attempt on November 10th, and the weather was right. We still retained a flaw,—a major flaw,—to which both our sponsors and our designers were firmly wedded,—the closed bottom balloon. Former justification on the grounds that freely mixing hydrogen with air was unacceptably dangerous lost its validity when we resorted to helium, an inert gas, as our lifting force,—but we stayed with the closed balloon.

That evening, during inflation, we reaffirmed the fact that wherever fallible man is in operation potential bungles are ever present,—we bungled. In the pre-inflation inspection the chief rigger reported that the mouth of the inflation sleeve was clear and that gas would flow directly to the crown of the bag with no fabric blocks to trap it. This was in error. The mouth of the inflation sleeve was partially blocked and this blocking developed an isolated pocket, hidden in the folds of fabric, which, with the continuing flow of gas, became over-pressurized and the bubble bursted.

With the sound of that dull blast we began a methodical search through two and a half acres of loosely folded fabric for the source and cause of that explosion. One hour later we found it,—a seventeen foot tear just below the equator of the bag.

With the discovery of this fabric rupture we became swamped with advice from almost every member of the expedition, and there were many members, who felt that he might have solution to the problem we were facing. They were all negative solutions,—we couldn't repair such a tear in the field,—we couldn't tailor the patch to fit the tear,—the rubber cement would not set in zero weather,—common horse sense demanded that we cancel the flight. That was the one source of advice I did not have available to me,—we had no horses in the camp.

To escape these well-meaning advisers I went with my repair crew into the folds of fabric and helped a little with the mending. With a roll of fabric, a can of rubber cement, and two 500 watt electric bulbs, to bring the temperature up to the degree at which the cement would set, we completed the job in an hour. To give us space in which to work, twenty cavalrymen, performing a new military role, made a tent out of the fabric surrounding the tear by serving as supporting posts. They made us a very satisfactory work shop through this improvisation.

While the direct and immediate cause of this tearing accident can be charged to faulty inspection its major contributing cause was faulty design. Orthodox balloons have always been inflated from the bottom and that's how we inflated this one. It's a simple operation with a small balloon. It is very difficult and impractical when massive folds of fabric can trap and pocket incoming gas. An inflation appendix in the crown of the bag would have by-passed these folds and have removed all chance for the accident we experienced. Hindsight taught another lesson and charged its fee.

The delay in repairing the tear put us two hours behind our schedule. We had planned to leave at five, but didn't get off till seven. We met a little atmospheric turbulence as we came out of the bowl and from this got our only thrill in the flight. A down-draft of air on the crown of the balloon stopped our ascent and demanded the discharge of 800 pounds of lead dust

for the gondola to clear the rim of the bowl.

On our way up we stopped at 16,500 feet for a final outside inspection. Next we sealed the gondola, put our liquid air evaporating system in motion and checked the functioning of our automatic pressure control valves, which were set to maintain 8 pounds of atmospheric pressure in the gondola. This check completed we discharged ballast and headed directly for the ceiling, canceling a preplanned stop at 60,000 feet because of our delay in getting off.

On the way up my full attention was focused on rate of rise and the expanding bag. I was particularly concerned about the possibility of any shock adjustment as the bag unfolded. None occurred; it unfolded smoothly as the gas expanded, becoming fully inflated at 65,000 feet. From this point on I continued to discharge ballast until we reached an indicated altitude of 73,000 feet. Ballast remaining at this altitude was 1,800 pounds of lead dust and 1,400 pounds of disposable equipment,—mostly batteries. Computation, with the most reliable factors at hand, indicated a need of 2,800 pounds of ballast for a controlled landing at the earth's surface. I could not predetermine the amount of additional gas that it would be necessary to valve to get back into the lower layers of atmosphere. But knowing that this was only our initial flight, I decided to err on the side of safety and kept the 400 excess pounds as a safety cushion. I dropped no more ballast.

TOP:
Precision Landing

CENTER:
Instantaneous Bag Decapitation

BOTTOM:
Mission Concluded

From the time we sealed the gondola Steve was a busy man with his scientific recording laboratory and frequent demands for radio reports.

After one hour and thirty minutes we started down. I was a little behind schedule and wanted to be sure that I was back at the surface while the sun was still shining. In the rarefied atmosphere it took a lot of valving to start it down and keep it coming. I valved at a very disturbing rate to get it down to under 40,000 feet. This gas that I was discharging I preferred to keep for landing. At 40,000 feet it began to maintain its rate of descent without valving. By the time we had reached 37,000 feet I was already discharging ballast to keep that rate within acceptable limits,—800 feet per minute. I dropped ballast continuously from this altitude to the landing and still had 300 pounds remaining. This would have been consumed had I been forced to remain in flight another twenty minutes. It worked out even better than we had planned it.

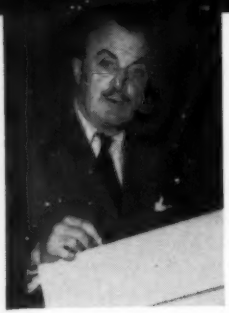
This final flight proved that we had, after a few growing pains, produced a worthy and operationally safe stratosphere balloon.

While in the stratosphere the scientific laboratory made in excess of 15,000 photographic recordings. Among the sixty-three separate studies conducted cosmic radiation both in density and direction, was one of the more important. Samples of living spore and the embryo fruit fly were taken along to measure mutation on living organisms resulting from increases in cosmic, or nuclear radiation. At our ceiling this nuclear radiation had increased to 80 times the density recorded at the point of take-off. Samples of atmosphere at the ceiling were poured into vacuum containers and brought back for measuring change in composition.

For our contributions to the field of scientific research we got a few rewards and commendations.

Since this flight two other stratospheric ventures have been launched. Poland, in 1938, made perhaps the boldest. They built a bag 700,000 cu. ft. larger than the Explorer II. They returned to the more efficient hydrogen as the lifting gas. They made the error of trying to inflate it in the open and a very modest wind caused the bag to collapse. They were set to go again in 1939, when, on September 1st, the Germans invaded and brought that expedition to an abrupt ending. Had they had a protective shelter available to them for inflation, this balloon had the capacity to go well above 90,000 feet,—which was their objective.

With the much lighter plastic fabrics now available for bag construction that goal can now be easily reached. The Navy team of Ross and Lewis, who got to 76,000 feet on their first venture, and then met a little trouble in control,—a characteristic of initial efforts,—will do much better on their next one,—and this is progress.



HALF A CENTURY *of Air Power*

By SIR JOHN SLESSOR, *Marshal of the Royal Air Force*

("Half A Century Of Air Power" is the substance of a lecture given by Marshal of the Royal Air Force Sir John Slessor at the Ohio State University Military History Course, Columbus, Ohio, August 27, 1956.

Marshal Slessor has had an exceptionally distinguished career. He has been an RAF instructor, Army Staff College; Director of Plans, Air Ministry; Assistant Chief of Staff to the Air Ministry; Air Officer Commanding in Chief, Coastal Command, 1943; Commander-in-Chief, Royal Air Force, Mediterranean and Middle East; Deputy Commander, Mediterranean Allied Air Forces, 1944, 1945; Marshal of the RAF, 1950, and Chief of the Air Staff, 1950.

He is the author of the classic, AIR POWER AND ARMIES (1936), STRATEGY FOR THE WEST (1954), and THE CENTRAL BLUE. This last volume will appear this month in the American edition published by the Praeger Press.)

I

The history of the rise of air power and its influence on war is a vast subject of which I can only attempt in one lecture to summarize very briefly what I think are the highlights, in the hope that I may stimulate your interest and encourage you to explore the subject more thoroughly for yourselves. Air power has yet to find its Mahan; but over the last thirty or forty years a number of books have been written which will repay study—not least among them the Official History of the U. S. Army Air Forces in World War II and the three volumes of the short popular history of the Royal Air Force, 1939-45 . . . .

Today, the influence of the machine over the whole military field by air, sea and land is too obvious to need elaboration. But I am not among those who believe that push-button warfare is just around the corner. I do not believe, for instance, that the manned aircraft will be entirely replaced by the missile in the foreseeable future.

Anyway, however mechanized all instruments of war may become, the ultimately decisive factor will still be the *man* who uses them. Remember, a characteristic of all war is muddle and uncertainty, the influence of the unexpected, chaos in greater or lesser degree—in another world war probably to the ultimate degree. And the side which in these conditions maintains its cohesion and direction (or, at best, loses it least)—the man who retains his balanced judgment in the face of fear and perhaps of almost unbelievable calamity, comes out on top . . . .

Someone once truly said that there is no pain equal to that of the impact of a new idea, and if we look back to

the earliest beginnings of aviation before World War I we can find instances of that truth. In 1907 the British Admiralty were offered the Wright patent. The First Lord courteously replied, "I have consulted my expert advisers with regard to your suggestion as to the employment of aeroplanes. I regret to have to tell you, after the careful consideration of my board, that the Admiralty, while thanking you for so kindly bringing the proposals to their notice, are of opinion that they would not be of any practical value to the Naval Service." The professional head of the Army said that aviation was "a useless and expensive fad, advocated by a few individuals whose ideas are unworthy of attention."

I have no doubt that similar examples could be found in American records. Indeed it was a well-known American general who said, soon before the intervention of the U. S. in World War I, "I see no reason why the range of the military aeroplane should ever exceed three days' march by the Infantry. An independent air force, if adopted and maintained, can only contribute to disaster and defeat in war."

But we need not waste time on these early beginnings. Remarks of this kind sound ludicrous today. But let us reflect that perhaps this sort of thing was not so unnatural several years before a great war in which the largest single item of bulk supply to the forces in the field was still forage for the horses.

In the war of 1914-18 air power was still too much in its infancy to have a decisive influence in its own right. And this, I think, is important to remember, because it means that the war of 1939-45 was really the first air war. And so when we look back on our errors of judgment and the shortcomings in our planning in those later days before the outbreak of World War II, do not let us forget that we had, to all practical intents and purposes, no experience on which to base our judgments. We in the Air Staff in London in those days made many mistakes. Many of the estimates on which we based our strategic advice to the Government turned out to be badly wrong—mainly in the time required and the strength necessary to achieve a given result. But, in view of our almost total lack of relevant experience, we may perhaps claim that what is really surprising is, not how wrong we turned out to be, but—once we got the weapons of the necessary quality in adequate numbers—how right.

In the main theatre of World War I (which was not really a world war in the sense of 1939-45), namely the Western Front from Switzerland to the Belgian coast, the air forces were almost exclusively ancillary to the armies—until just before the end in 1918 when the first beginnings of what we now call strategic bombing made their appearance. Their primary responsibility was close tactical co-operation with the army, reconnaissance and—in particular—observation for the enormous volume of artillery fire that was such a decisive feature in that vast, grim siege. The order of battle of the British air forces at the time of the great German offensive in March 1918 is significant; of the 1232 aircraft in the line 409 (or about 33%) were in army co-operation squadrons, 610 were fighters whose main job was to enable the army squadrons to do their work and only 213 (or about 16%) were bombers . . . .

Nevertheless, quite early in that war the concept of direct action by air forces against the enemy army—as

opposed to the mere provision of information and observation of fire for our own—did make its appearance on lines which are at least recognizable as the forerunners of the vastly more formidable and effective air operations that were such a decisive contribution to the success of the Normandy Invasion and to victory in Italy in 1944. As early as the battles of Neuve Chapelle and Loos in 1915, the plans included programmes of railway bombing in a serious attempt to dislocate the movement of reserves and supplies behind the enemy's front. It is significant that some of the strongest pressure came from officers who were responsible for our own supply and transportation and who were thus in the best position to estimate what might be the effect of successful interdiction of a supply and transportation system. Early in 1918 Colonel Wingfield, head of the supply staff of the 2nd Army, was agitating for a concentrated and properly co-ordinated programme of bombing of the enemy's communications in terms which were well ahead of his time; soon after the war he wrote in the Army Quarterly, in an article based on his own experience, "the maintenance of an army in the field may be prejudiced—even totally prevented—if the enemy's aircraft is successfully handled." . . . .

I have not the time to elaborate further on this early recognition of the vital importance of the principle of concentration in air warfare. But I cannot resist quoting from the directive to the British and French air forces issued on April 1st 1918 (the day the R.A.F. came into being) by Marshal Foch on his appointment as Supreme Commander, because it shows how well the principle was understood by Foch and his great staff-officer Weygand who signed the directive.

"*Bombing.* The *essential* condition of success is the concentration of *every resource* of the British and French bombing formations on such few of the *most important* of the enemy's railway junctions as it may be possible to put out of action with certainty, and to keep out of action."

We now know, of course, that it was too much to expect decisive results with the rudimentary weapons of that day. But almost equally fatal to success was the command organization which split up the available air forces into penny packets under army commanders and made any effective concentration impossible. It is odd that the air force command themselves did not react more strongly against this system—it may be because the senior air officers were then still basically soldiers. (Trenchard, by the way, was no longer commanding in France in 1918.) Perhaps it must be said that, though Foch thoroughly understood the principle, he did not understand how to give effect to it by insisting on a reorganization of the command system.

Again, that first war 40 years ago produced the first object lessons in the truth which is now a commonplace, that air superiority is essential if operations on land are to be brought to a successful conclusion. The R.A.F. War Manual defines air superiority as "a condition in which we are able to make use of the air for our own purposes and the enemy air forces are unable to operate effectively against us." In that sense we can claim to have held air superiority throughout that war, because we were never prevented from carrying on the essential work for the army, which then was the purpose for which we wanted to use the air.

That is not to say that we always

had it all our own way. Far from it; indeed there were times when, if we had air superiority, it was only in the moral sense. The advantage in the air changed hands 3 or 4 times during those four years, as one side and then the other put aircraft of superior quality into the line. But I think we can claim in spite of that, that the Air Force never failed the Army. And the reason for this deserves special attention because it was the basis of what became a cardinal feature of British and later on American Air Force policy, and the secret of our success. Briefly it was that throughout those grim years, often at fearful loss, we always carried the air war to the enemy. . . .

It is impossible to exaggerate the importance of this offensive principle—it is basic in air warfare. On the short term it may be expensive in casualties; but it is vital to morale and it always pays off in the end—as we were to see so clearly in the first great air war a quarter of a century later.

Before we leave World War I we must take a look at perhaps the most important concept about air warfare which had its beginnings about 40 years ago—that of what we should now call the strategic use of air power. . . .

Let me explain. The Royal Air Force came into being on April 1st 1918 as an autonomous fighting service under an Air Ministry. The first and very temporary Chief of the new Air Staff said later that at that time he "managed to secure a margin" over the requirements of the campaign in France, to form an air force to bomb Germany. The conception, which sounds reasonable enough to modern ears, was definitely to break down the enemy military and economic system in Germany and cripple the sources of supply of the German army. Remembering how completely new all this was at the time, we should not be too critical of what we can now see to be the fantastically ambitious nature of this aim with the weapons of that day. Actually, of course, these early strategic bombing efforts were on a diminutive scale; in 10 months of 1918 the independent force dropped a total of 666 tons—just about a quarter of what Bomber Command dropped on Berlin in one night about 25 years later. The project for a much larger Inter-Allied bomber force, and the plan to bomb Berlin with the 4-engined Handley Page bombers designed specifically for the purpose, never came to fruition because the armistice of 1918 came too soon.

What was unsound about all this was the conception that there was some fixed upper limit of air strength required in all circumstances for what was then universally and rightly regarded as the decisive task, the support of the armies in the field; and that once that level was reached then the "margin"—anything left over—could be used permanently for quite independent operations against Germany. There was everything to be said for having a strategic air force and for bombing Germany whenever possible; actually that could profitably have been done much earlier and many more squadrons allotted to it, instead of being frittered away on piece-meal and quite inconclusive bombing up and down the front under half a dozen different commanders. But the force should have been used as a strategic bomber force, should always be used—on the job that is of decisive importance at the time.

Actually at that time when the new air staff "managed to secure their margin" we were in the greatest danger in the main theatre of war. The great German offensive of March and April

1918 was in full swing, Paris and the channel ports were in jeopardy and people like Nash were calling almost desperately for concentrated bombing of the ensuing line of supply. Trenchard, as I have said, was all for bombing Germany when the necessary strength could be spared from the battle fronts; but he did not like the conception of an independent force specifically for the bombing of Germany responsible direct to the Air Ministry. He thought the force should come under the Commander-in-Chief in the field, to be used as a sort of G.H.Q. reserve of air power to be used where the need was greatest, and not *only* against Germany.

Of course he was right. Remember 1944; at that time the necessary weapons were available in quantity and quality, and the direct air operations against the German military and industrial economy—Pointblank and the offensive against oil, based on the Casablanca directive—were having results that were ultimately decisive. Nevertheless, when the situation elsewhere, in the great campaigns on land, became really critical, when for the time being the decisive point shifted for some reason or another *from* Germany, then when necessary the main weight of the bomber offensive shifted with it. You may claim if you like that, had we concentrated our effort on breaking down German resistance by air and not undertaken these vast adventures like Overlord, the bomber offensive would itself have been decisive, sooner, and at far less cost in lives. I think at least a very good case could be made for that. But since it was, rightly or wrongly, Allied policy to undertake these campaigns on land, then it can not be argued that we were anything but right, in their critical stages, to direct the bomber effort temporarily to their support—such as at Battipaglia during the Salerno landing, at Caen during the struggle for the bridge-head and, above all, the massive offensive against the enemy transportation system in Northern France, without which the Normandy invasion might have been a failure.

It is easy enough to criticize the men of 1918—remember our then complete lack of experience of air warfare. And it is significant that no less a person than Foch was even then so impressed with the potentialities of air power that he said, soon after the war, that the moral effect of air action might force a Government to sue for peace, and thus become decisive. . . .

II

Finally let me turn to what can only be a far too sketchy survey of the influence of air power in the first great air war in history. I am going to deal with that under three main headings—the maritime air war, the land-air war and the strategic bomber offensive. For you in the United States the war began with an episode which, once and for all, provided the conclusive solution to the controversy which, ever since Billy Mitchell's day, had exercised the minds of military thinkers under the title "Bomb versus Battleship"—the U. S. Fleet was decimated by Japanese aircraft in Pearl Harbor. Within a few weeks of that disaster, two great British battleships, the Prince of Wales and Repulse, were sent to the bottom within a matter of minutes by a few Japanese aircraft in the Gulf of Siam.

Even if time allowed I need not here expand on that theme; it is surely universally recognized today that the "Mighty Mo" and the Vanguard are as obsolete as Nelson's three-deckers. But I think there may be a moral to be drawn, not only by sailors but by airmen. The great surface ship, in a

different and more modern form, remains the capital unit in the British and United States fleets. True, its tactical function is that of a floating airfield, but the fact remains that it is a great surface ship. We can admit that all the vastly expensive paraphernalia of defense of the modern carrier task force is immensely formidable; and I think that for some time to come there is a valuable role for them in the limited wars which in my view are the likely pattern of war in the near future. But I think that is a passing phase. All this—the A. A. guns and missiles, the defensive fighters, the airborne early warning and so on—is matched and indeed outmatched in first-class war by the modern means of attack on the surface vessel—the jet-bomber, the guided bomb and the nuclear warhead. There would also be a grave menace to the land-based airfield—at least until vertical take-off becomes a practical proposition for long-range strike aircraft and the manned bomber is reinforced and in part replaced by the inter-continental ballistic missile.

What I am getting at is that in my view the days of the striking base on the surface—whether of the sea or of the land—may be numbered. I hope and believe that the manned bomber will not give way entirely to the missile—at least for many years to come—because it seems to me that the former will retain a capacity for tactical flexibility, including evasive action, that may be impracticable for the latter. But the launching gear of the I.C.B.M. will surely have to be deep underground. And not only carrier-captains but also S.A.C. base commanders should not be too sure that, before they are very much older, their proud commands will not have to yield pride of place as the primary striking arm to the atomic-powered submarine with the guided missile.

It is in no sense to minimize the importance of the vast American naval campaigns in the Pacific—in which sea-borne air power was the decisive arm—to remind you that in fact the greatest threat at sea to Allied interests in World War II was the U-boat, which had brought Great Britain to within an inch of defeat a quarter of a century before. It is perhaps natural that we British should be more acutely conscious of that fact than you in America, since we depend not only for an ability to wage war, but for our very existence upon the safe and timely arrival of shipping in British ports. That might well not apply to another total war, which I can not believe could conceivably last for any length of time. But in both the great wars of our generation the security of the Atlantic lifeline has been vital, not only to British survival but to Allied strategy as a whole.

In 1914-18 air power was too much in its infancy to have any significance in this regard. But in Hitler's war the contribution of air power to the defeat of the U-boat was decisive in the maritime affair. In another great war the most effective counter to the U-boat might be to destroy them in port and obliterate their bases. But in 1939-45 there was no such short cut. It is true that towards the end the bomber offensive began to take a heavy toll. Sixty-six, or about 7% of the total number of U-boats in commission lost throughout the war by known causes were destroyed by bombing in port; and—still more important—over 100 more were destroyed in course of construction, and the production of the new schnorkel-fitted Mark XXI and XXIII boats, which would have been such a terrible menace had they got to sea in any strength, was decisively delayed—only nine of this class went to sea before the surrender, out of the

400 planned for delivery by the end of 1944.

Nevertheless it remains broadly true that throughout the war the only means of eliminating mortal loss to Allied shipping was to destroy U-boats at sea.

I well remember in the early days of the war the benign amusement with which the admirals received a claim that a U-boat had been sunk by an aircraft—rather like a kindly uncle whose small nephew claims that he has shot a bear with his little pop-gun. And Doenitz was so unwise as to commit himself in 1942 to the statement that "aircraft can no more eliminate the U-boat than a crow can fight a mole." He was soon to regret that boast.

It is true that it took time, and we suffered terrible losses in shipping and cargoes, before the aircraft really took the measure of the submarine. But from 1943 onwards, when aircraft were available in adequate numbers, with the right weapons and with the range to reach out into mid-Atlantic, the shore-based aeroplane became the decisive answer to the submarine. Let the figures speak for themselves. Of the 826 German, Italian and Japanese submarines sunk by Allied action at sea throughout the war, 303 were sunk by shore-based aircraft—367 if carrier-borne aircraft are included. British and American shore-based aircraft actually sunk one more German U-boat than the surface vessels of the R. N. and U. S. N.—246 to 245. No doubt Admiral Doenitz had time in Spandau prison to reflect that after all the crow was not such a bad mole-catcher as he had thought. . . .

I have time only to refer very briefly to one other aspect of the air-sea war air action against enemy surface vessels. Six out of the 10 major vessels of the German Navy and 29 out of the 71 major vessels of the Japanese Navy were sunk by aircraft. Of other shipping, nearly 2 million tons were sunk in the Mediterranean by the R.A.F.; while in the Pacific American aircraft sunk some 3 million tons of enemy shipping.

Turning now to land-air warfare, it is impossible within the scope of a lecture like this to do justice to the all-pervading influence of air power in the land campaigns of 1939-45. As F. M. Montgomery wrote in 1946, "experience in this war has proved beyond doubt that all modern military operations are in fact combined army/air operations." And the scope of air power in these campaigns extended far beyond the actual battlefield—whether it was the cutting of Rommel's Mediterranean lifeline which finally deprived the Afrika Korps of its essential mobility in the desert, the transport support and supply operations that alone made possible the re-conquest of Burma, or the paralysis of movement in Northern France which was so vital to the success of Overlord.

But the decisive impact of direct air support to armies in the field must not obscure in our minds the vital truth that the primary task and most-far-reaching effect of air power in a land campaign is to create that condition of air superiority without which no land operations can be brought to a successful conclusion. By that I do not mean that an army can not fight at all without air cover or support. There could be no more dangerous fallacy than that, and we should be careful not to let our memories of the last two years of the late war lead us to expect always to be able to fight regardless of enemy air power. The Germans showed us, particularly in Italy, that a disciplined and determined army can fight stubbornly in defence and even stage formidable local counterattacks in the face of virtually complete enemy

air superiority.

Nevertheless it is true that for the major offensive on the ground which is essential to victory in a land campaign, air superiority is indispensable. From Alamein onwards the Luftwaffe was never anything more than, at worst, a fairly serious nuisance; and army commanders were able to make and carry through their plans virtually regardless of enemy air. And, as I have already said, we owed that decisive degree of air supremacy primarily to what I call the unseen campaign by the bombers, carrying the war to the enemy, driving him onto the defensive and depriving him of the initiative, causing him to build fighters at the expense of bombers and forcing him to concentrate those fighters on close defence of his vitals, leaving his armies in the field virtually unsupported. . . .

In direct support, the true function of air power can be summed up in the words "paralysis of movement." Except in dire emergency the Air is not a battlefield weapon. In all the great land campaigns its true value lay in its capacity to dislocate to a fatal degree movement *behind* the battlefield—movement of reserves, of supplies of all sorts, ammunition, fuel, rations and so-on. Read Rundstedt's comments on Overlord and books like Shulman's "Defeat in the West" for details of how effectively it did just that in the invasion. . . .

Finally an all-too-short word about the air war proper—the strategic air offensive.

I do not want to burden you with statistics, but must just quote a few because, though we all know that the bomber offensive was a combined effort, I doubt whether it is commonly recognized how evenly that effort and its cost were shared by the American and British air forces. The total tonnage of bombs dropped in the war on Germany and German-occupied territory was about 2.7 million, of which 1,462,000 were by the U.S.A.F. and 1,236,000 by the R.A.F., who also laid in enemy waters 47,000 mines which took a terrific toll of enemy shipping. The U.S.A.F. lost almost 10,000 aircraft, the R.A.F. 12,000, and the personnel list in action was almost exactly the same—79,000 for each of the forces. The British bomber effort against Germany cost us about an overall 7% of our direct national war effort—about 5% in terms of manpower; I do not know the corresponding American figures, but doubt if they were very different. . . .

That the bomber offensive was ultimately a war-winning factor of cardinal importance, no one will deny. It is equally true that it was four years before it assumed decisive proportions. It must be admitted that in our ignorance in the early days we grossly underestimated the strength required to have significant results. In 1939 we had only about 300 bombers available for strategic operations, inadequate in range and bomb-load, without self-sealing tanks or any of the radar aids to navigation and bomb-aiming which later became a commonplace, and with bombs totally inadequate in quality. Fortunately the German bomber force, though numerically far greater, was equally unfitted for its task, as we proved in the Battle of Britain. Two years later we still had only about 400 available for operations in Bomber Command, and the heavies—the excellent Lancasters, the best night bombers of the war—were yet to come.

It was not only our initial weakness and inexperience which caused such delays in the build-up. In the opening years we were on the strategic defensive, for nearly two of them alone against Germany and Italy. And in

these circumstances we obviously could not concentrate as we would have liked on winning the war—we had to ensure ourselves against losing it. We were constantly having to divert not only aircraft but whole squadrons from Bomber Command to strategically defensive tasks in the Battle of the Atlantic and to reinforce our fronts overseas, in the Middle and Far East.

You do not build up a great bomber force from scratch in a matter of minutes. Even after the intervention of America, it was over two years before your bomber forces in Europe began to assume really significant proportions.

The figures are eloquent. Up to the time when the bomber offensive was given point and direction by the Combined Chiefs of Staff in the Casablanca directive of January 1943, the total tonnage of bombs dropped on German-occupied territory (mainly by the R.A.F.) in three years was 104,000. In the following year, 1943, that total was rather more than doubled. But in the first four years of war the total tonnage was only 330,000. In 1944 it was 1,118,000 and in the last sixteen months before V.E. Day it was 1,596,000—an average monthly tonnage about equivalent to the whole weight dropped in the first 3¼ years, and a total of nearly five times as much as the first 4¼ years put together. Incidentally I think it is of some interest that the proportion of the total tonnage dropped on different classes of target included 32% (the highest) on land transportation targets, 24% on industrial areas, 9.3% on oil, chemical and rubber targets and 1.8% on aircraft factories. Actually these were the targets which we had selected as being of primary importance in our pre-war bombing plans. We were right enough about what we ought to destroy; we were hopelessly wrong about the effort required to destroy them.

I have no time to discuss interesting problems such as area versus precision bombing or the role of the bomber offensive in wearing down German fighter strength. For that sort of thing you must refer to the official histories and the excellent report by the D'Olier Committee—the U. S. Strategic Bombing Survey. Perhaps it is hardly profitable to speculate whether Germany could have been brought to her knees by the bomber offensive without invasion—I wonder indeed whether, in the light of post-war events, it would even have been to our advantage for Germany to capitulate with none but Russian armies on continental soil.

For what it is worth, my own view is that had we given rather more priority to the bomber forces, and particularly to all the scientific aids that were so indispensable, we might well have forced the surrender earlier and enabled the armies to return to the Continent as an occupying and policing force, instead of hurling them against the Normandy beaches. No-one can tell. But it is significant that as early as August 1943, after the devastating attack on Hamburg by Bomber Command in which about 60,000 people were killed, that very good judge Speer told Hitler that "if these aerial attacks continued, a rapid end to the war might be the consequence." If we had been able to lay on another dozen Hamburgs in quick succession, who knows what might have happened.

The bombardments of the early years, though costly in lives and insignificant in their direct practical results, were nonetheless indispensable. Not only could we learn the essential lessons only in the hard school of actual operations; but by persisting in

the face of loss, we did begin quite early to wrest the initiative from the enemy and throw him back on the strategic defensive. A German staff report written in 1944 is interesting; it read: "At the beginning of the war operations of the German Air Force determined the character of events; the initiative has now, however, since 1941 been in the hands of the enemy." The moral is the old one, that in air war an offensive policy pays off every time, even when one's strength is quite inadequate to give immediately decisive results.

In assessing the impact of the Bomber Offensive on Germany, the real point is summed up in these words of the D'Olier Committee: "The air offensive did not attain major significance till the Spring of 1944. Of the total tonnage dropped in the European War by the R.A.F. and the A.A.F., 83% was dropped subsequent to January 1st 1944. Of the tonnage dropped on Germany proper, in the neighborhood of 85% was subsequent to that date. Perhaps even more significant is the fact that of all the tonnage dropped on Germany, 72% was after July 1st 1944. If the bombing of Germany had little effect on production prior to July '44, it is not only because she had idle resources upon which to draw, but because the major weight of the air offensive against her had not been brought to bear.

After the air war against Germany was launched on its full scale, the effect was immediate."

Let me end by summing up the part played by air power in World War II, again in the words of the U. S. Strategic Bombing Survey.

"Allied air power was decisive in the war in Western Europe. Hindsight inevitably suggests that it might have been employed differently, or better in some respects. Nevertheless, it was decisive. In the air, its victory was complete; at sea its contribution, combined with naval power, brought an end to the enemy's greatest threat—the U-boat; on land, it helped to turn the tide overwhelmingly in favour of Allied ground forces. Its power and superiority made possible the success of the invasion. It brought the economy which sustained the enemy's armed forces to virtual collapse, although the full effects of this collapse had not reached the enemy's front lines when they were overrun by Allied forces. It brought home to the German people the full impact of modern war with all its horror and suffering. Its imprint on the German nation will be lasting."

THE MEN *and the Machines*

PART II

January 1915-April 1916

A Chronological Treatise on the Growth of Air Power

(Editor's Note: This is the second part of the treatise on the Army's air growth from 1913 until the entry of the United States in World War I. The first installment appeared in the October 1956 issue, and the final part will appear in the April 1957 issue.)

During the year 1915, the Aviation Section was still hampered by the provisions of the Act of 18 July 1914 in obtaining and keeping personnel. The Act had specified that only unmarried lieutenants of the line under 30 years of age would be eligible for service with the section. Only 34.4% of both the first and second lieutenants of the line of the Army could qualify. Of these, only 27% could pass the required physical examination. The requirement that an officer be unmarried was considered useless because the service was purely voluntary and no married officer would apply for aviation duty unless he had carefully considered the extra hazard, which was only partially compensated for by increased hazard pay. The age limit of 30 years was not only unnecessary, but a detriment to military aviation, as was the provision that an officer had to return to his original branch of the service when he was promoted to captain.

As has been pointed out the need for an advisory committee on aeronautics was well known, but Congress did not approve of one until 3 March 1915. On that day the Naval Appropriation Act was approved and it provided for a National Advisory Committee for Aeronautics, which was to be composed of 12 members appointed by the President. Langley Field had been selected as the site for the Army engineering development station and the NACA was invited to set up its facilities there. The outbreak of war forced a change in Army plans but the NACA went ahead with its plans and established the Langley Memorial Aeronautical Laboratory named in honor of Dr. Samuel Pierpont Langley.

Signal Corps Flying School Activities

During the early part of the calendar year 1915, Lt. B. Q. Jones established a new official endurance record of 8 hours and 53 minutes in a new Martin TT tractor. He also performed the first intentional stalls in this modern airplane. Later on he set an official endurance record for three persons. For the two record feats he was awarded the Mackay Trophy for that year.

B. Q. JONES

In March 1915, in order to comply with Section 3 of the Act of 18 July 1914, certificates were prepared for

Junior Military Aviators as well as for Aviation Mechanicians. On 10 April instructions were issued by the Chief Signal Officer providing that a candidate for the Junior Military Aviator badge had to demonstrate his flying knowledge by "operating a machine" in a triangular cross-country flight without landing; the minimum length of any side was to be 20 miles. Further, the candidate had to make a straightaway cross-country flight of at least 90 miles without landing, and during this flight was to remain for half an hour at an altitude between 2,500 and 3,000 feet. Then too, he was required to make such starting and landing flights as the board required.

By July the specifications for the examination had been expanded as General Scriven noted in a letter to the Division of Militia Affairs:

> *Flying:* Five figure 8's around pylons, keeping all parts of the machine inside a circle whose radius is 300 feet.
>
> Climb out of a square field 900 feet on a side and attain 500 feet of altitude, keeping all parts of the machine inside of the square during the climb.
>
> Climb 3,000 feet, kill motor, spiral down, changing directions of spiral and land within 150 feet of a previously designated mark.
>
> Land with dead motor in a field 800 feet by 100 feet, assuming said field to be surrounded by a 10-foot obstacle.
>
> Land within 100 feet of a previously designated mark with dead motor from 500 feet of altitude.
>
> Cross-country triangular flight without landing, of approximately 60 miles, passing over the following points: Starting from North Island over Del Mar, La Mesa and Coronado Heights.
>
> Straightaway cross-country flight of about 90 miles, without landing, from the vicinity of Santa Ana, California to North Island.

Still other conditions of the examination required the making of fittings, assembly, balance and alignment of the airplanes, theory and practice of gasoline engines, meteorology and navigation. (As aviation developed, it must be borne in mind that these requirements also changed.)

A freak accident happened on 8 April 1915 when Capt. Dodd was piloting a rebuilt Burgess. He was enroute to San Francisco from San Diego, accompanied by Sgt. Alvah E. Baxter and flying at about 2,300 feet. He was trying to economize on fuel, when he noticed a bright colored ring in the blur of his whirling propeller. The ring widened and the plane began to vibrate so violently that Dodd was afraid the tanks would be torn loose. Immediately after he cut off the engines the propeller shaft snapped off in front of the crank case. He was able to make a crash landing in an oat field near Encinitas, 35 miles from North Island. After the landing the propeller was located and it was found that the leading edge of one blade had a piece knocked out of it and another long piece of wood had been broken from the trailing edge. It was believed that the rabbeting of the tip to fit the brass tips flush had weakened the blade where the long sliver had peeled off, and that the freshly exposed wood produced the light colored ring.

A similar accident occurred on 26 June 1915 to 2nd Lt. Edgar Gorrell in a Martin tractor, on a non-stop trip from San Diego to Long Beach. The propeller cut away the tires of the front wheels and slightly dented the rims of both when it flew off. Gorrell had cut off the ignition switch the instant the vibration started and at-

tempted a stalled landing in an open ploughed field, and the airplane turned over on its back, but without doing much damage other than a wrecked landing gear. These two episodes marked the beginning of a long series of difficulties with propellers.

Mexican Border Duty

Lts. T. DeW. Milling and B. Q. Jones, as part of the 1st Aero Squadron, were ordered on 13 April 1915 to Brownsville, Texas, for border patrol duties. They took with them one airplane, the necessary accessories and eight men. They traveled by express train, arrived on 17 April, and pitched a tent camp at the west end of the old cavalry grounds.

However, Pancho Villa, the villian of this little episode, had started withdrawing his troops on the night of the 15th of April, and had completed his withdrawal the day before the cadre arrived.

No wireless radios were carried with the airplane and the terrain was too rough to permit the use of signalling cards. As a consequence nothing was really accomplished by the experimental field mission, except the definite realization that a system had to be developed that would permit airmen to cooperate more closely with the field artillery.

Flying and Ground Training

Mostly through hit and miss procedures the techniques employed in the training of students at the Signal Corps Aviation School showed marked progress with the passing of the months. It was discovered that more take-offs and landings could be achieved in aircraft equipped for water operations and for a long time a civilian instructor, Doc Wildman, was in charge of this phase of the training program. Following the water training, the student transferred to the land plane, and when the civilian instructor, Oscar Brindley, decided he was able to fly alone, he was put in the care of the Officer in Charge of Flying Training, and was allowed to fly alone, after checking out, until he felt he was proficient enough to try for the FAI pilot's license. This was followed by cross-country flying training and then the test for the Junior Military Aviator rating.

In the ground phase of training the program was successfully reduced by the development of new ideas and techniques. By mid 1915 officials of the school felt that both officers and enlisted men had learned more in their six months program than had been previously anticipated in the much longer programs.

On 12 July 1915, a Board of Officers of the SCAS adopted Aviation Mechanician examination requirements. The first part of the examination required the student to make fittings, ribs, spars, struts, skids and wires; assemble, disassemble and align an airplane; prepare the plane for shipping; stretch cloth on the wing frames and dope it; remove, repair and replace tires. The second part required the candidate to clean the engine, grind the valves, adjust the clearances, time valves and spark; clean magnetos; locate and repair firing systems; adjust the carburetor and locate and adjust other ordinary troubles. In addition, the student had to pass a physical examination.

It might be interesting to note here, while talking about the flying school, that during the first six months of operation in 1915, the school used about 6,000 gallons of gasoline. (This is considerably less than can be carried on *one* of our present-day large aircraft.) Gas cost 10.4 cents per gallon and was furnished by the Union Oil

Company of California.

Another note of interest in connection with the flying school was the adoption of the Deperdussin control system for airplanes. This system which was in general use in Europe resembled the popular Curtiss system and consisted of a wheel on a pillar, which was rotated for lateral control, and moved back and forth for elevation control, while a rudder bar served to coordinate in turns.

The month of May 1915 marked the appearance of the first of a long line of airplanes which were to become quite famous up to and through World War I, and which were affectionately dubbed as the "Jennies". The first Curtiss JN2 model was accepted by the 1st Aero Squadron and was distinguished by its low rakish lines, staggered wings and a fuselage that was long and unusually deep and narrow.

Goodier Court-Martial

As so often happens, an incident of shattering proportions has to serve as the instrumentality for pointing out certain weaknesses and deficiencies in a system. The Goodier court-martial starting in the Spring of 1915 may be termed just such a cathartic, although the evils which it purported to rid the service of could never be really substantiated. Lt. Col. Lewis Goodier, Sr., father of Capt. Lewis Goodier, had assisted Capt. T. F. Dodd and Lt. W. R. Taliaferro to prefer charges against Capt. Arthur S. Cowan, head of the San Diego school at that time. In addition, Goodier senior, in his own behalf, pressed charges against Cowan and against Capt. W. L. Patterson. The charges stipulated that both Cowan and Patterson were receiving flying pay when neither was actually able to fly. An investigation by the Judge Advocate General revealed that the charges could not be sustained, and Lt. Col. Goodier, Sr., was then court-martialed for his part in filing the charges. He was found guilty of conduct prejudicial to good order and discipline, and on 17 April 1916 was reprimanded by President Wilson.

Evidence presented at the trial showed that at the time the charges were preferred against Cowan and Patterson, both men were drawing flight pay but neither was a qualified pilot. This fact was known to Lt. Col. Samuel Reber, Officer-in-Charge of the Signal Corps Aviation Section. Cowan's record showed eleven "straightaways" or runs just above the ground for a total of 24 minutes flying time. Patterson, rated a Junior Military Aviator, received about 54 minutes of training and was not capable of flying solo. Evidence further revealed that Cowan and Reber had succeeded in having Capt. Lewis Goodier, Jr. relieved from the aviation service while he was in Letterman General Hospital recovering from an airplane accident.

Prior to the opening of the court-martial, the Judge Advocate General, Brig. Gen. E. H. Crowder, had ruled that Cowan's failure to become proficient was due to the pressure of his other duties and the lack of equipment. He had also ruled that as long as Cowan held himself in readiness to fly, he was entitled to flying pay. The JAG further ruled, that while Patterson's rating might have been in error, it was not, in fact, invalid, and he was allowed to retain his JMA rating. The rulings, it was felt, may have been legally sound, but they did leave some obviously bad conditions uncorrected. However, Lt. Col. Reber and Capt. Cowan were subsequently relieved of their commands.

The bit of evidence presented here cast a long shadow of continued friction, for it was revealed that perhaps the basic cause of the trouble existed

in the difference of opinions between the older officers of the Signal Corps and the younger flying officers of the Aviation Section, who wanted an air organization separate from the Signal Corps. This friction had long since been prophecied by Capt. Paul Beck.

Activities, 1st and 2nd Aero Squadrons

On 22 May 1915 the Adjutant General notified the Chief Signal Officer that the Secretary of War had directed that steps be taken as soon as possible to transfer an aero company to the Philippine Islands. At the same time Brig. Gen. C. R. Edwards who was Commanding General of the Canal Zone appealed for two aero squadrons to be located within the Canal Zone. This official request was denied but the War Department announced that following the original plans for establishing the 2nd Aero Squadron in the Philippines, the 3rd would be established in Hawaii, and the 4th in the Canal Zone.

The Quartermaster General drew up the estimated housing cost for the establishment of the four aero squadrons:

Philippines	$145,600
Hawaii	141,000
Panama	175,000
San Antonio	10,000
Total	$471,600

The 1st Aero Squadron, officially reorganized by Capt. B. D. Foulois, and consisting of 15 officers, 85 enlisted men and eight JN2's, together with the necessary camp equipment, left San Diego on 26 July 1915 for Fort Sill, Oklahoma, where they were to take part in Fire Control operations with the Field Artillery. The officers of this group were:

Capt. B. D. Foulois, CO
1st Lt. T. D. Milling
1st Lt. J. C. Morrow
1st Lt. C. G. Chapman
1st Lt. J. E. Carberry
1st Lt. T. E. Bowen
1st Lt. B. Q. Jones
1st Lt. R. H. Willis
1st Lt. R. B. Sutton
1st Lt. S. W. FitzGerald
1st Lt. Leslie MacDill
1st Lt. A. R. Christie
1st Lt. H. W. Harms
1st Lt. Ira A. Rader
1st Lt. Harry Gantz

Although the Squadron was at Ft. Sill from 29 July to 19 November very little work was actually accomplished with the Field Artillery. Too much time had to be spent in building the camp; two airplanes were sent to Brownsville, the others were grounded or out of commission most of the time and Lt. Sutton was involved in an important accident which killed Capt. G. H. Knox, QMC.

Immediately following the Sutton accident twelve of the officers held an informal meeting in which ten of them maintained the JN2 was unsafe and should not be flown, especially with a passenger. Capt. Foulois agreed that the plane was not all it should be, but added that he was attempting to get others; T. D. Milling asserted that the airplane was safe within its capabilities.

However, in order to forestall any further trouble, and because the airplanes were actually in poor shape, Capt. Foulois recommended on 1 September that no further aerial reconnaissance or artillery fire observations missions be undertaken until all of the airplanes were again in commission.

Meanwhile, a detachment of four officers and fifteen enlisted men had left Ft. Sill for Brownsville again with two JN2's. The officers were Lts. Morrow, commanding, Jones, Christie

and Harms. They experienced much difficulty with the JN2's in the field, and after Lt. Morrow wrecked one of them and injured himself, the officers

LT. J. C. MORROW

submitted an unfavorable report on the airplane.

Actually no one was satisfied with the JN2's. Capt. V. E. Clark, a graduate in engineering from Massachusetts Institute of Technology, had reported after inspecting the planes after their delivery, that he would condemn them all. The planes were turned over to a board for testing in August 1915, and the tests showed that the planes were too heavy for the power delivered. By the middle of January 1916 the JN2's were modified to JN3's.

The San Antonio Air Station

Until now, off and on, the idea for a central air training station kept cropping up in the minds of the planners. After much preliminary research, San Antonio had been selected as the ideal spot for such a center. In March 1915, and before he took charge of the 1st Aero Squadron, Capt. Foulois was sent to Ft. Sam Houston to prepare the plans for the station and make an estimate of the costs.

After the Ft. Sill fiasco, from 19 to 26 November, the 1st Aero Squadron made the first squadron cross-country flight from Ft. Sill to Ft. Sam Houston, 439 miles, in six JN3's, making several stops along the way.

On the 23rd of November, Lt. Carberry, who was leader of the flight, was blown off course by a heavy wind between Waco and Austin. He was followed by Rader, Chapman, and Foulois, all of whom landed at various places after discovering the error, and then finally made it into Austin. Meanwhile, Lts. Milling and Bowen flew low, followed the railroad and reached Austin without incident.

By the 31st of December 1915, there were 15 officers of the Aviation Section assigned to Ft. Sam Houston, and there were 84 enlisted men on duty at the same place.

Taliaferro Accident

Just prior to the Goodier court-martial,* Lt. W. R. Taliaferro, who was listed as one of the complainants, was killed in an airplane accident on 11 October 1915. He was considered one of the Army's best pilots and had just set an unofficial one-man endurance record of 9 hours and 48 minutes on 17 September 1915. At the time of the accident Taliaferro was attempting to loop a Curtiss J at about 2,000 feet; he reached an upside-down position but was unable to complete the loop, and slid off into the waters of San Diego Bay with terrific force. His body was found 24 hours later pinned beneath the wreckage of the machine in fifty feet of water. He be-

* In the Spring of 1915 Taliaferro and Capt. Dodd, with the assistance of Lt. Col. Goodier, Sr., had preferred charges against Capt. Cowan. The actual court-martial proceedings against Lt. Col. Goodier took place in a few days after Taliaferro's death in October 1915.

came the sixteenth man to be killed in the U. S. Army aviation service

2nd Aero Squadron

The first company of 2nd Aero Squadron was activated on 22 May 1915 by the Chief Signal Officer, but the actual organization did not take place until 1 December 1915, at San Diego. On 5 January 1916 the first company set sail for Manila. There were six officers and 37 enlisted men. The officers were:

Capt. William L. Patterson, Commanding
1st Lt. Douglas B. Netherwood
1st Lt. Redondo B. Sutton
1st Lt. S. W. FitzGerald
1st Lt. Earl L. Canady
1st Lt. Leslie MacDill

At the end of the calendar year 1915, the Aviation Section listed 23 airplanes and 17 spare engines as part of its inventory. In addition, the strength for that date was 44 officers and 224 enlisted men. The Section had grown somewhat during this calendar year. This Flying Section also had two passenger carrying automobiles, twelve auto trucks and one auto ambulance.

Pertinent Legislation—1916

As a result of the furor stirred up by the Goodier court-martial proceedings, Senator Joseph T. Robinson of Arkansas introduced SJ Resolution 65, in January 1916, calling for an investigation of the Aviation Section. An advocate of the bill in the House of Representatives was Congressman Charles P. Caldwell of New York who pointed out that the purpose of the resolution was to get information necessary for framing a new law which would put America out in front in the field of aviation. He further pointed out that many of the deplorable conditions which existed in the Signal Corps just prior to the framing of the resolution had been corrected, because the Army, in advance of any adverse legislation, had conducted an investigation and housecleaning of its own. Probably this was the reason that the resolution which had already passed the Senate was not even voted on in the House.

During the hearings on the Military Appropriations Act for the fiscal year 1917, on 8 April 1916, Secretary Baker presented his opinion that the primary difficulty that existed in the Aviation Section was the result of the impatience of the young and eager officers with the regulations and restrictions which had been imposed upon them. He described the situation as largely "tall talk," and pointed out that there had never actually been any acts of insubordination. He announced the appointment of Lt. Col. George Squier as head of the Aviation Section, and Capt. William Mitchell later became his assistant.

On 3 June 1916, the National Defense Act was passed and it was Section 13 of this act which particularly benefited the Aviation Section. Personnel strength was raised considerably and the restrictions relative to married officers and ages were removed. Further, Sections 37 and 55 of this Act provided for the Officers Reserve Corps and the Enlisted Reserve Corps.

Congress, influenced by the possibility that the United States might at any time be drawn into the war which was already raging in Europe, on the 29th of August, authorized $13,281,666 for military aeronautics. $600,000 was allocated for the purchase of land for training sites, and for the first time in the history of military aviation the Signal Corps actually had enough money to develop aeronautics.

Already the sniping against Billy Mitchell had started. The Aero Club of America insinuated at this time that Billy Mitchell was impeding the progress of military aeronautics, and charged him with inefficiency. The Aero Club was disgruntled because they had played an important part in obtaining the large appropriation for aeronautics and they felt that about $9,500,000.00 of it should be spent on developing the National Guard. Apparently, Billy Mitchell did not agree with this contention, and after investigation, Secretary Baker upheld Mitchell.

On the 29th of August, the same day the appropriation for aeronautics was made, the Council of National Defense was created. It consisted of the Secretaries of War, Navy, Agriculture, Interior, Commerce and Labor. This law also authorized the establishment of an Advisory Commission to be comprised of seven civilians possessing special knowledge of the industrial and commercial resources of this country.

Aviation Section

Early in 1916 the Aviation Section consisted of the Aeronautical Division, temporarily headed by Capt. William Mitchell, soon to become a Major; the Signal Corps Aviation School at San Diego, headed by Col. W. A. Glassford; the 1st Aero Squadron, headed by Capt. Foulois (which left Ft. Sam Houston in March for duty with the expeditionary forces in Mexico); and the 1st Company of the 2nd Aero Squadron in the Philippines, with Capt. Patterson, Commanding.

A General Staff Committee appointed by the Secretary of War in April 1916 to investigate the Aviation Section discovered in studying the development of aviation in Europe, that each army was accompanied by organized air units performing the following principal functions: reconnaissance, direction and observation of artillery fire, bombing, and aerial combat. Each of these functions required a particular type of airplane. It was also found that the main purpose of the Aviation Service was to provide the aviation personnel and planes. It was recommended by the committee that the Aviation Section be put under a central control in the War Department and completely separated from the Signal Corps; that it be organized as a training-operations agency; and that there should be a military organization for the channeling of machines and personnel into proper tactical units for active military duty.

Besides the flying school at San Diego, plans were being developed to open schools at Chicago, Ill. and at Mineola, N. Y., where the 1st Aero Company of the New York National Guard, the only one mustered in Federal Service, was already training.

More Pancho Villa and Mexican Border Incidents

On the 8th of March 1916, Francisco "Pancho" Villa, the Mexican outlaw, crossed the international border with a force of about 500 to 1,000 men and killed 17 Americans at Columbus, N. M. The U. S. Cavalry chased Villa across the border and Gen. John J. Pershing was directed to organize a force for pursuit, and the 1st Aero Squadron was ordered to duty with Pershing's Punitive Expedition.

Leaving Lt. Harry Gantz in charge of the new Air Center at Ft. Sam Houston, the following officers left San Antonio for Columbus, N. M., on 13 March 1916:

Capt. B. D. Foulois,
Commanding

Capt. T. F. Dodd
1st Lt. C. G. Chapman
1st Lt. J. E. Carberry
1st Lt. H. A. Dargue
1st Lt. T. S. Bowen
1st Lt. R. H. Willis, Jr.
1st Lt. W. G. Kilner
1st Lt. E. S. Gorrell
1st Lt. A. R. Christie
1st Lt. Ira A. Rader

Moving with the unit were 82 enlisted men, one civilian mechanic, and two medical enlisted men. A medical officer, 1st Lt. S. S. Warren, and an additional corpsman joined the squadron on 14 March.

The equipment in this move consisted of eight Curtiss JN3's, ten trucks and one automobile. Two additional trucks were received from the Quartermaster Depot at El Paso, and this gave the squadron about 50% of its mechanized equipment.

Other officers who joined the squadron at irregular intervals after settling at Columbus were:

Capt. John F. Curry
1st Lt. B. Q. Jones
1st Lt. H. W. Harms
1st Lt. Ralph Royce
1st Lt. Roy S. Brown
1st Lt. B. M. Atkinson
1st Lt. H. S. Martin
1st Lt. John B. Brooks
1st Lt. John C. Walker
1st Lt. P. L. Ferron
1st Lt. J. D. von Holtzendorff
1st Lt. Geo. E. Lovell
1st Lt. Carl A. Spaatz
2nd Lt. G. E. A. Reinburg
2nd Lt. John W. Butts
2nd Lt. S. H. Wheeler
2nd Lt. L. G. Heffernan
2nd Lt. Davenport Johnson
2nd Lt. M. F. Harmon
2nd Lt. Maxwell Kirby
2nd Lt. C. W. Russell

A few days after establishing their home base in Columbus, N. M., it was decided to have an advance base at Casas Grandes, Mexico, and all eight planes were to be moved there. The movement which began on the 19th of March, scattered planes and pilots all over that vicinity of Mexico, and it took four or five days to get them all together again, although one of the planes was so badly damaged it had to be abandoned.

All in all, the flyers encountered many unusual and unforeseen circumstances. A number of different factors: strong winds over the mountains, lack of navigational equipment and maps, strange territory, and inadequate maintenance caused many accidents and aborted missions. By the end of March it had become evident that the airplanes available were not capable of doing the job desired.

The Squadron did manage to maintain almost daily mail and reconnaissance flights between the home base at Columbus and the advance bases, which kept shifting about.

(To be concluded in a later issue.)

MILITARY AIRCRAFT *and their use in Warfare*

By MAJOR GENERAL MASON M. PATRICK
Chief, U. S. Army Air Service

(This is the substance of an address given by Major General Mason M. Patrick on the occasion of The Centenary Celebration of the Founding of THE FRANKLIN INSTITUTE and the Inauguration Exercises of The Bartol Research Foundation, September 17, 18, 19, 1924.

General Patrick commanded the Air Service and later the Air Corps, with needed vision, insight, enthusiasm and organizational skill, in the critical era after World War I, 1921-27. He was born in West Virginia on 13 December 1863, and died at Walter Reed General Hospital in Washington, D. C., on 29 January 1942.

He entered the United States Military Academy on 1 September 1882 and became a Second Lieutenant in the Engineers on 1 July 1886. On 5 August 1917 he was made a Brigadier General; as a Major General he was appointed to be Chief of the Air Service on 5 October 1921 and retired on 31 December 1927.

Readers of this article may be stimulated to read his book, THE UNITED STATES IN THE AIR, Garden City, N. Y.; Doubleday and Doran, 1928, with an introduction by F. Trubee Davison, Assistant Secretary of War in charge of Aviation. This book provides a readily accessible account of General Patrick's views with regard to World War I experience and the controversies regarding the organization and roles of the Army Air Service during the Billy Mitchell era.)

In all of the conflicts in which contending forces have struggled for victory, up to the beginning of the World War, footmen and horsemen constituted the armies; and moving on the surface of the earth, they met each other in battle, and the issues thus decided often changed the political map of the world. The triremes of the Greeks and Romans, the sailing vessels that followed them, the dreadnaughts and superdreadnaughts of modern navies, all these surface craft have been used by man when he conducted his wars on the high seas. In all these wars, whether by land or sea, the fundamental strategic principles remain unchanged from earliest time and nothing can alter them. Man has, however, taken advantage of all of the discoveries in science and in the arts to increase his offensive and defensive power; has originated, invented new methods and new weapons of warfare. One of the most notable developments during the World War was the use of aircraft in battle . . . .

Heavier-than-air craft or airplanes were used for military purposes for the first time during the World War. The far-reaching importance of the proof given by the Wright brothers that man could actually fly was scarcely recognized in their own country. Foreign governments, or at least their military men, seemed more alive to this, and at the outbreak of the war, England, France and Germany had

each a few crude planes, though Germany placed her main reliance in her Zeppelins and, as we know now, had made her plans in advance for destroying Paris and London by bombs dropped from them. Airplanes were at first used solely for observation purposes, visual reconnaissance. The airmen themselves knew little of what they could or should do and the commanders of the ground troops knew less. The value of the information thus secured was, however, soon grasped. From time immemorial, army commanders have sought or desired vantage points from which they could see what was taking place during the progress of a campaign or a battle. It was Wellington who said he would give half his army if he could know what was going on beyond yonder hill. The advantage gained by the height airplanes can attain has already been pointed out. Moving rapidly, they can cover great areas and again they can convey quickly to the proper place the result of their observations.

It was soon seen that while important to obtain information, it was most desirable to prevent it from reaching the enemy. Then came the era of air fighting with planes specially designed and built for this purpose.

As is usual under war's stress, developments came rapidly. The speed and carrying capacity of planes increased greatly. The uses to be made of them multiplied. And so, to-day, profiting by the experience gained in the war and by our subsequent study, we have airplanes of four different types, each intended for a specific use, although it may be well to say that under exceptional conditions planes of any type might be employed to do the work normally required of another type or of other types.

The first, the so-called pursuit or combat planes, single seaters, armed with two machine guns, their prime mission to seek out and to destroy enemy airplanes. They are fast, very manoeuverable and our present service type can make about 165 miles per hour with its military load. We shall soon have such planes capable of making 185 to 200 miles per hour. They must be able to climb 10,000 feet in a little less than ten minutes and capable of operation at altitudes of from twenty-five to thirty thousand feet. It is essential to obtain command of the air in order that our own planes may be reasonably safe from enemy attack . . . . This is the function of the pursuit planes and pilots. They are instructed and trained to know that while they are themselves making it safer for our slower planes to operate, the protection thus afforded is incidental, it is given by the execution of their own prime mission, the seeking out and destroying enemy planes. At almost the end of the World War, fighting planes operated independently and single combat was joined by individual planes. This practice has been supplemented by effective aerial formations, involving the fundamental, tactical principle of support and reserve. This in order to prevent the dissipation of air forces and in order to bring the greatest possible concentration of attacking power on the enemy formations, striking him on converging lines. Normally these pursuit formations fly at three different elevations, the highest being the reserve, the next highest the support.

Our observation planes are two-seaters, carrying a pilot and an observer, who supplements his visual reconnaissance by photography, the planes being equipped with specially designed aerial cameras . . . .

The result is that the design of practically every military airplane is a

compromise. There is a minimum load which must be carried, manoeuverability, too, is essentially important in planes which must attack or which must defend themselves from attack. The average pursuit pilot who knows that in combat his own life is at stake will prefer a plane easily manoeuvered even though this means the sacrifice of speed.

We are continually developing and improving our airplanes and the advance in design is already very great. Just sixteen years ago when we bought our first army airplane from the Wrights, it was required to make forty miles per hour and to carry, besides its fuel, the equivalent of 350 pounds. It was doubted whether these severe requirements could be fulfilled. Today, a speed of over 250 miles per hour has been made and the Army's Barling bomber weighs 26,000 pounds, can carry a load of 15,000 pounds and can fly with it at the rate of eighty miles per hour.

In dealing with the missions of military aircraft, so far I have dwelt almost entirely upon their use against land objectives, enemy troops, enemy establishments or other land activities. It must not be forgotten that they can also be used against water craft and most effectively.

During the World War, little use was made of aircraft against hostile shipping, against transports or against naval craft, except against submarines. Notable experiments carried out by our own Air Service in 1921 and again in 1923 proved conclusively that bombs delivered from aircraft could put out of action or sink any naval craft which up to this time has been designed or built. Phosphorous bombs, striking on a vessel, make it impossible for anything on its decks to live. Direct hits by bombs carrying high explosives do great damage, but it was also shown that it was not necessary to make a direct hit in order to sink any naval vessel. Bombs exploded under water and near a vessel were sufficient to send it to the bottom, or even when it did not accomplish this, the blow dealt might be so staggering that the first effect would be to put the vessel out of action. While the aircraft in these experiments operated freely and without being themselves exposed to attack, we of the Air Service are satisfied that no fire can be delivered from a vessel's deck sufficient to make her safe from an attacking air force . . . .

The Round-the-World Flight planes passed over the city of Philadelphia just eight days ago, their long journey nearly done. This flight, about completed, has taught a number of worthwhile lessons. From a military standpoint, this flight has shown that no distances or no difficulties are great enough to make any country immune from attack by aircraft. On the other hand, and to stray from the subject a moment, this same flight has shown how communication between the nations of the world can be improved, how parts of the earth otherwise almost inaccessible or without sufficient means of transportation and communication, can be brought nearer and thus enable men to know each other better.

As to the possibilities of the use of aircraft in future wars, it may be worth while to quote some of the opinions of others. General Duval, who was Chief of the French Air Service during the war while I was in charge of the Air Service of our own Army, says:

"The primary objective of the air force will be the enemy armies and especially those parts of them in the areas beyond the fighting line in which it will carry disorder and terror. It

will fight in the air for air supremacy and the liberty of action which follows. Its power will grow with the number and development of its airplanes which will be more heavily armed, will be speedier, and will have greater radii of action. The battle will no longer be confined to the zone occupied by the troops. In fact, the object of the attack may no longer be the opposing army, as this may be neglected and the desired results may be obtained by a campaign of terror carried on against the enemy country rather than against its armed forces. The decision will be reached in the air and the victor will dictate peace on the ground."

Colonel Fuller of the English Army pictures thus an attack on ground troops:

"We see columns of foot and horse wending their way toward their battle areas, whole divisions twelve miles long toiling along dusty roads. Then we see in the distance tiny specks on the horizon, they grow bigger, there is a droning of engines—twenty low-flying armored battle planes top the rise in front, and, before the wretched infantry have time to unstrap their limbered vehicles and mount their machine guns, there is a rattle of musketry and in ten minutes the whole column is traversed from front to rear, 250,000 bullets have been pumped into it and the very dust of the highway is churned into a porridge of blood. Such warfare as this is truly horrible, because it is so one-sided. To shoot down infantry in this manner is mere massacre."

In 1921, Marshal Foch said:

"The potentialities of aircraft attack on a large scale are almost incalculable, but it is clear that such attack, owing to its crushing moral effect on a nation, may impress public opinion to the point of disarming the Government and thus become decisive."

The late Premier of England, Bonar Law, said:

"The whole centre of gravity has changed in the matter of national defence from the sea to the air."

In a speech that Lord Birkenhead delivered on May 9, 1923, he said in part:

"In every field of military preparation, it has been the habit of this country inveterate, incorrigible, to refuse always to anticipate those crises which experience and the study of history have, none the less, taught us over long periods to be inevitably recurrent.

"In the last few years an immense and incalculable permanent change has taken place in conditions which is vital and fundamental, and upon which the security and very existence of this country depend. It has become clear, beyond a doubt, that it is no longer possible to estimate the security of this country in military or naval terms, but that there has arrived a third term, namely, that of an aerial security.

"This problem of air defence is, in the years that lie in front of us, as vital a question as the strength of the navy was to those who preceded us in Parliament in the last thirty years."

The English Admiral, Mark Kerr, has written :

"War is an affair of communications. No admiral or general would attempt any move unless his communications were assured.

"There is only one arm which can strike at once a real blow at each one and all of the above links in the chain of the enemy's communications. Each side will then endeavor to be the first to attack by air and unless we are

ready to do this, our people will feel war as they have never felt it in all their history. Poison gas, poison acids, high explosives, and incendiary bombs will be raining from the air wherever there is a factory or arsenal to be destroyed.

"Above all, remember that, where as in former times it took days, weeks or months before any heavy blow would be dealt after the commencement of war, now, with the new power of the air, a fatal blow may be delivered from the air which may practically finish the war within a few hours from the time when the enemy made up his mind to attack."

General P. R. C. Groves wrote the London Times:

"War, if it should come again, will begin with an aerial phase which may in itself be decisive. Those not in close touch with the enormous progress in aviation since the Armistice are inclined to underestimate air power and to judge it by the pinprick air raids of the past. The total weight in bombs dropped upon London in the course of the World War was about twelve tons. To-day several thousands of tons could be dropped on the capital in the course of twenty-four hours."

The well-known war correspondent, Frederick Palmer, wrote:

"The French reasoned: 'The thrift, skill and industry of our people will look after our economic recovery. Meanwhile, we must have a card to play against British interference with our plans for security.'

"The card was on the table the day of the French entry into the Ruhr in the form of overwhelming French air squadrons which could fly over any number of British battleships in the Channel and drop a shower of bombs upon the British coast and vital points inland. No longer has France to build a navy as a check to British power while she maintains an immense army against Germany. She has a force in the air which she can throw in either direction. This means a revolutionary change in Britain's tactical relation to the continent, which has existed since Caesar saw that, if he were to include the Angles in his triumph, he must have boats."

At any rate, there are two great lessons which were taught by the World War, the importance of which has been only emphasized by our subsequent study. First of all, an army without an air force contending against one so equipped is practically helpless. I have called the Air Service the eyes of the army. Without it, an army is blind and could no more fight effectively than could a blind man opposed to one who was able to see to parry every blow aimed at him, to plant at will upon his helpless antagonist the blows which he himself deals. The second and even greater lesson is that there is no effective defence against aerial attack except an air force of our own. Much is made by some of the possibilities of anti-aircraft fire and while such a method of defence must still be employed and may, under certain circumstances, be reasonably efficacious, it could not be relied upon to prevent absolutely an attack by aircraft. Our own experience during the war bears this out. Of all of our losses of aircraft and airmen, only about 1 per cent, were attributable to anti-aircraft fire. General Groves of the English Army states that in all the German raids over England during the World War not more than six airplanes were brought down by anti-aircraft guns.

With particular reference to attack upon naval vessels, the Air Service with the assistance of the Chemical

Warfare Service has developed material for placing smoke screens which will absolutely blanket a target and prevent those on shipboard from noting the approach of attacking planes. Fast-flying airplanes can actually surround a target with such a screen and, of course, similar smoke screens can be used when attacking land objectives . . . .

History could have taught us the same lesson even without actual experience in warfare. Whenever man has developed a new weapon superior to those previously in use, he has held his opponents helpless unless they too armed themselves with similar new engines of destruction. In earliest times men fought, and man has been fighting since he appeared on earth, with the weapons nature gave him, his hands, feet and teeth. Then some one of these ancestors of ours grabbed a club, and had not his antagonist done the same, this club wielder would have been king of his little world. Later, bows and arrows came into use and the archers dominated the field of battle until their opponents fashioned for themselves the same weapons. The mail-clad warrior was invincible when opposed by those not similarly caparisoned, but he, too, was vanquished by muskets and cannon and the sun of the day of chivalry went down in the clouds of powder smoke.

Therefore, it is repeated that the only defence against air attack is an air force of our own. So thoroughly is this grasped by military men that few to-day dispute it, and this is true not alone of land armies, but of navies as well. No fleet in the future will dare put to sea unless it has with it its air component. Airplanes will be used by the Navy for scouting, for carrying bombs and torpedoes. They must likewise have their combat planes or else the slower observation and bombing planes will be destroyed by enemy aircraft.

The fundamental military or strategic principles upon which war is fought are unalterable. For example, the definition of strategy attributed to General Forrest: "Getting there first with the most men," still holds good, but the coming into being of aircraft and their use in warfare does change profoundly our geographical isolation and materially reduces the time in which we might prepare for our defence after war is declared. The fact that we must have aircraft for military use will have a bearing upon the economic phases of our national defence problem and once more and for the sake of emphasis, it is again repeated, that the only effective defence against an air attack is an air force of our own.

These facts should be impressed upon our minds and the necessary action should be taken, in order that we may have the feeling of national security, the consciousness of our own power, of our ability to defend ourselves, which will strengthen our arm when we must raise it in the cause of right.

Furthermore, it has been pointed out that aircraft make it much more easy for men to know each other and with such knowledge comes understanding so that these, the most potent military machines ever devised by man, may likewise be agents for promoting the peace of the world.

A WAR DIARY

By LIEUTENANT ROLAND R. BIRNN

(Lt. Roland R. Birnn, as a young Army Air Corps Lieutenant, was killed on 4 July 1942, while test flying an A-20. Prior to this accident, Lt. Birnn had recorded in Diary form some of his impressions of the hectic activities, and frustrations endured, following the Japanese attack on the Philippines in December of 1941, and during the improvisation period in northern Australia in early 1942.)

14 February 1942

Brisbane

Got to Charleville, gassed up and took off. Engine started missing,—cut the throttle and landed. Had no brakes,—almost went through a fence. Engine was using excess oil and fouled up plugs. Wrong type plugs anyway. Am left behind.

20 February 1942

Charleville, Australia

Seventeenth Squadron arrived yesterday. Am going North with them today. Next stop, Cloncurry.

Arrived Cloncurry after flying over the worst country I've ever seen,—all desert with no check points. Lost two planes on the way up. Dengue fever is bad here—Hope I don't catch it.

21 February 1942

Daily Waters

Arrived here today. More desert but worse. Think we'll stay here a while,—they're having daily bombing raids at Darwin. Three days ago they almost wiped out Darwin with heavy raids,—50 bombers at a time. They caught B-24's, P-40's and Hudsons on the ground. They know how to shoot down B-17's,—make frontal attacks.

22 February 1942

Daily Waters

This place is really a hole. Hasn't rained in months and the ground is baked. I'm sleeping on it. The temperature is always above 100°. The flies are horrible,—they don't bite, just cover you and crawl. Have to wear a face net,—but can't put that over my food. No messing facilities,—food is bad. These Aussies just don't know how to eat,—no vegetables, no eggs, no taste.

We're losing our A-24's fast. Of the original 53 we now have only 22 that are flyable,—and this before we've had a day of combat.

24 February 1942

Daily Waters

Got a report the 91st Squadron (dive bombers) went out from Java and sank five ships—good score, lost two planes. Other bombers sank lots more.

C.O. of our Squadron went to India to take charge of light bombardment. Wish I could have gone. We're doing no good sitting here without planes. Heard they have some B-25's in Melbourne.

1 March 1942

Daily Waters

Still holed up in Daily Waters. Three officers of the 27th Bomb Group just arrived from the Philippines. They came in by sub,—took eight days. They were sure royally fed while aboard the sub. They were Bender, MacAfee and Stafford.

Can't understand why Colonel Davies hasn't sent for us;—we're doing no good here.

3 March 1942

Bachelor, Australia

Was flown here in an O-47 A today. Living here a little better than what we left. Still would take a lot of improvement to make it good.

Here's a laugh. Headquarters at Darwin sent all A-24's out on a patrol mission. If they had met any Zeros, which were all around the place, a slow underarmed ship like the A-24 wouldn't have had a chance.

6 March 1942

Bachelor

We were ordered out of Bachelor,—feared a Jap raid. Went South to Katherine. We are being rationed with 808th Engineers. First good food we've had for weeks. Same rations as the Australians,—but its prepared for eating.

Have a nice clear river nearby that we spend all day in,—nothing else to do,—we have no planes.

9 March 1942

Katherine

Left Katherine this morning. Arrived Bachelor and then told to go to Daily Waters. Wish they could make up their minds,—trouble is we get orders from three different sources.

10 March 1942

Daily Waters

Have a water famine here,—food just as bad. Our A-24's are going out fast,—now only 11 out of 53 fit for combat. Only one-half of a Squadron ever got in combat. Wish they'd do something with us,—we can't win a war sitting in Daily Waters.

Our morale is really shot,—we're losing interest in everything. With three times as many pilots as planes, and those planes not good for combat, its hard to keep our interest up.

Colonel Davies and four others went South to get some more dive bombers, —they're no good. Why don't they send us some planes we can fight with?

Heard the 3rd Group is in Australia with new planes. They always got the breaks. And to think I used to belong to that group,—sure wish I were still with them. Here in the 27th, with 80% of our pilots qualified to fly fast bi-motored planes, we're assigned this antiquated trainer. Been in Zone of Combat since war declared and haven't flown a combat mission yet.

14 March 1942

Daily Waters

Still at Daily Waters. A B-17 just came over and crashed,—it had three engines out. Crew were lucky to get out alive,—not much of the ship was left for salvage.

Yesterday three B-17's flew up from Melbourne. All three flew over the field but couldn't see it. Two got back to Melbourne, one made an emergency landing. They were told that Daily Waters is on a railroad,—nearest one is 90 miles. Wonder anyone gets anywhere with the maps and information they furnish here.

17 March 1942

Daily Waters

Twenty P-40's came through today, —started out with 27. One of the pilots, just out of flying school, rolled his P-40 just over the field and into the ground. Just doesn't pay to get hot. We are ordered back to Bachelor. Wish one of these orders would sometime have a meaning.

18 March 1942

Bachelor

Only 16 of those 27 P-40's left. General MacArthur came through the other day,—didn't stop at Darwin as the papers said. Said he would never fly again in one of those noisy B-17's. Brought out two truckloads of furniture and a Chinese servant. Plenty of furniture and servants here. Why

didn't he bring out pilots and trained mechanics? Guess that's the privilege of a General.

19 March 1942

Bachelor

The 27th got orders to leave for Townsville today. This is one time I don't mind moving. Don't like to sleep on open ground in temperatures as hot as Hades,—without water.

20 March 1942

Townsville

Arrived at Townsville via Cloncurry. My plane is in really bad shape. Every time I take off I don't think I'll make it,—but its better than staying behind. Only 11 of our planes are still flying. Nice field here,—paved runways, and camouflaged.

The 3rd Bomb Group is here. A good setup. They don't have any ships so they can work on ours. Soon as my plane stopped rolling 10 mechanics started working on it. They were really eager. They hadn't seen a plane for three months and sure wanted to work.

So far I've had 3 planes. All the motors went out in less than 70 hours on each. Something wrong when new motors go out for excessive oil consumption.

Hope we get assigned to the 3rd Group. They have only 9 pilots per group, of which only 5 are experienced. We're a group of experienced bi-motored pilots flying advanced trainers that some crackpot figures can be used in combat. Would sure like to have him here.

28 March 1942

Charters Towers

Am assigned to the 3rd Group,—makes me happy. A bunch of pilots just went south to get some B-25's.

31 March 1942

Charters Towers

Just got checked out in B-25. Good plane but A-20A flies better. Am in the 90th Squadron,—a good outfit with a bunch of old friends.

A-24's went North today,—hope they do some good.

Our B-25's really belong to the Dutch. They bought them and are as mad as hornets:—but we're better equipped to fly them;—and I guess that's war.

Some of our big shots must be going nuts. A certain staff colonel had an order cut making the 3rd Group an Infantry unit because we had no planes. It was our luck that the order was cancelled, and he was removed. His mind must have got a little foggy.

The staff in various headquarters work from 8:30 to 4:30 and then complain about the heavy work they have to do. In spite of them I hope we win the war. There are some good men in the staff,—they do all the work.

Just got ordered south to Brisbane to get a B-25. We now have the B-25, A-20, and A-24 in the group. Quite an assortment of planes.

3 April 1942

Brisbane

Arrived here today but no B-25. Sat opposite a staff major at luncheon today,—made me a little sick with his talk. He kept complaining about the food and service, which, to me, was really good. Found he had never been farther north than Brisbane. Wish he could have been with us and eaten the slop we had to. I'll never complain about food anymore if I ever get out of the Northern Territory,—and I'll forget that experience just as soon as I can.

Funny thing about food, when its bad you never hear men talk about women,—just the steak and ice cream they're going to consume when they get to where that type of food is being served. Women seem to rank a poor second to food as man's first love.

11 April 1942

Brisbane

Got orders to get back to Charters Towers,—big mission coming off. The mission is up to Philippines,—hope I get to go.

12 April 1942

Charters Towers

Taking off tonight for Mindanao to run bombing raids from there on Japs in Northern Philippines.

Took off but never did get assembled,—black as pitch. We straggled into Darwin from dawn to about two hours later. Some of the pilots found themselves flying out to sea when dawn broke. No reliable maps to navigate by and no landing aids at Darwin.

We're gassing up to take right off, but I'm not going,—lost one of my tires in landing here. Hope replacement gets here in time for me to take off tomorrow with the others that are being left behind. The next leg will be a 1600 mile trip over water and Jap bases. Too bad if Del Monte, Mindanao, is closed in when planes arrive, —they'll have no alternative field that they can get to.

13 April 1942

Darwin

No tire yet. Schmidt and I are getting disgusted,—spare tires should have been here before we arrived. We just operate without any timely planning,—and that's not good. Got a bunch of good P-40 pilots here,—all just out of school but they're packing up experience. The other day they caught 7 Jap bombers and shot them all down, —good going.

This field is suffering from alert jitters,—anything brings on an alarm. One of our own planes, an Australian Whirraway, easily recognized, flew over the field and brought on a full-scale air alert. Perhaps I'll be jittery too if I stay here much longer. But right now its really funny to see them run for cover when the alert signal goes off. I run, too, but I'm not jittery yet.

Morale and spirit are low here. Their only concern is about getting out. They don't seem to have any interest in improving their food and living conditions, and they're both bad. While they have to live here they should do a little to make things better. Believe it would give a healthier outlook on life.

14 April 1942

Darwin

Too late now to go on the P. I. mission. The ship bringing our tire is missing. Patched up my own and ran a search for the missing plane,—found it out of gas, in the only open field in that part of the country. They were lucky boys (Petrie and Hall).

The group got back from P. I. this afternoon without losing a ship. They got shot up a bit, but the small bullets the Japs use won't go through the gas tanks,—25 caliber. They pulled a lot of raids which didn't do much damage, —need more practice.

Each ship came back loaded with pilots. Even though the bombing missions may not have been too successful, bringing out these pilots made the operation worth it. They brought out about 33 officers and men,—not a very big salvage from the 1500 that were in the 27th Bombardment Group.

19 April 1942

Charters Towers

Returned here yesterday. Was alerted at 1:00 A.M. to fly to New Guinea to fly a recon mission. Gassed at Port Moresby and took off at 9:00 A.M. to reconnoiter the N.E. coast of New Guinea.

Saw lots of beautiful islands with native buildings and white beaches,—just like you see in the movies. Couldn't go back to Moresby until after 3:00 P.M. as the Japs raid the field almost daily.

Landed at Moresby, gassed, and took off for Townsville. Lucky to get in at Townsville,—all other fields were closed and it was after dark. Townsville just happened to be open. Tired of riding my luck. Had 17 hours of almost continuous flying,—less time out for gassing.

20 April 1942

Townsville

Headed back for Moresby today. Arrived and spent the night under the wing of my plane.

Took off at dawn to patrol. They briefed me that there were no mountains in New Guinea higher than 14,000 feet. I flew by one with my altimeter reading 16,500. New Guinea is just a mass of mountains,—90% of the country is wild. Lots of gold and lots of mining camps,—some above 13,000 feet.

Covered the N.W. corner of New Britain, then New Hanover and part of New Ireland. Saw two large Jap transports in the Harbor. Flew around them but got no A.A. fire. Went across the channel to Kavieng. Saw nothing at the airport but some Jap activity in town.

On the way home flew over Solomons and took pictures. Then turned out to sea and flew over Lae, which was heavily infested with Japs. Just as we got over the field I saw five Zeros climbing up to meet us,—never seen airplanes climb so steeply. Some nearby clouds offered me some cover and I got into them as fast as I could. No fun being caught out alone by Zeros.

Pictures turned out O.K. We saw 21 Jap planes on the field.

After gassing at Moresby we returned to Townsville with an overall flying time of 27 hours out of 60. Moresby was considered too dangerous to remain overnight.

22 April 1942

Townsville

Returned to Moresby. Took off the next morning to patrol the Rabaul area. This is the strongest Jap base in this part of the world,—located on the N.E. corner of New Britain. B-26's bombed the docks just before we arrived,—which helped to warm things up for us.

As we approached we saw 3 B-26's pass under us being chased by 4 Zeros. There were plenty of clouds so we were not seen. A few minutes later we saw more Zeros, but gave them the slip in the clouds. We covered the Rabaul-New Ireland area always taking advantage of clouds. We picked up three transports off Rabaul Harbor, took pictures from low altitude of York Island, just off the mouth of the harbor. On our last trip over we got some A.A. fire which put a small hole in our tail and then saw a Zero closing in.

We took to the clouds and headed for home. While passing over the St. George's Channel we picked up a surfaced submarine. We strafed it and it immediately disappeared beneath the surface. Hope we sank it or, at least did some major damage. Had a lot of fun this day.

24 April 1942

Charters Towers

Came in here today,—could do with a little rest. We've lost 3 B-25's to weather. Moresby closed in and they had to land in open water.

29 April 1942

Charters Towers

Headed back to Moresby to recon again. Covered the South Coast of New Guinea on the way. Saw a flare just off Amazon Island,—investigated and saw three men in a small boat. Buzzed them and dropped a note that I had their location and would report.

They could be the crew of one of the ships we had lost to bad weather. Three of them, all inexperienced had been forced down by bad weather while enroute to Moresby. Its a wonder that we don't lose more. We're always fighting weather, without much of a weather service to help us.

30 April 1942

Port Moresby

Another patrol. Flew to Buna Bay, to Woodlark Island, to Bougainville, to New Britain—then back to Buna Bay. While over Buna Bay was hopped by 5 Zeros. Didn't have enough gas to dive down to sea level and head for the open sea, as I had to cross over mountains. So started climbing at full throttle; leveled off at 12,000 feet. On the way up we shot down two Zeros,—one each by the upper and lower gunners. The bombardier got a broadside on a Zero with his 30 caliber and it moved out and didn't attack again.

When I reached some clouds I went straight into them. There were supposed to be mountains in them, but I had to get away. The Zeros did not follow us in.

Really funny how one reacts to an attack. I would look out and see a Zero start his pass, his tracers were streaming in front of my face; he continued the attack until you could see his face,—yet it never occurred to me that I could be hit. I did, however, get a delayed reaction after it was over. I think it was a miracle that they didn't shoot us down. No fun being caught alone by a flight of Zeros.

I returned to Charters Towers the next day for repairs. Almost got caught by the Japs at Port Moresby, —took off 5 minutes ahead of a raid.

4 May 1942

Port Moresby

Back at Moresby,—arrived at dark yesterday. Took off at 6:30 A.M., had to stay out until 2:30 P.M.,—makes a gruelling flight. Covered Lae, then New Britain, then Bougainville. Didn't see a check point for 3:45 hours. Then I mistook a large Jap carrier and 2 heavy cruisers for islands. Went in to investigate. They spotted me and started to zig and zag. At the same time Zeros began taking off from the carrier, so I headed away at full throttle. A little later I picked up two subs and one sub tender. I couldn't stop to strafe and expose us to the Zeros which couldn't be too far away.

At the New Guinea coast I ran into a front which I couldn't fly over, and which was so rough that I couldn't fly through. By heading northwest toward Lae I finally found a hole which let me fly across the mountains, partially on instruments at 16,500, and then land at Moresby during an alert. It was quite a day.

I, myself, had caused an alert a few days before when the 5 Zeros hopped me. Some town in the mountains had reported that one bomber escorted by five Zeros was headed for Moresby. I was in the bomber but the Zeros were not giving me friendly escort. They shot us full of cannon holes.

The carrier we saw today was later destroyed in the Battle of the Coral Sea.*

Have now flown for seven straight days with an average of over seven hours a day.

(To be concluded in a later issue.)

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* The Battle of the Coral Sea was fought three days later, May 7-8, 1942.

NEWS ITEMS

Memberships and Change of Address

Your membership renewal becomes due each year on the anniversary date of your original membership certificate. You can automatically take care of your renewal by simply forwarding the annual $3.00 dues to The Air Force Historical Foundation. Your continued membership, as well as expanding membership rolls, are necessary for the sustenance and growth of our organization and for the growth and development of our publication. As the membership rolls grow, so also will *The Air Power Historian.*

When you have finished reading your copy of *The Air Power Historian* pass it along to your buddy, or place it in a library reading room; encourage your friends to join the Foundation.

Another important facet of membership is insuring that we have your current and correct address. When the publication is sent out to an incorrect or outdated address, it is returned to us, because it is mailed as second-class matter and cannot be forwarded. When it is returned, we have to pay additional postage. This causes duplication and waste, but more often than not, you get cheated out of your quarterly publication, which you have paid for and are entitled to, and which we want you to have. We feel certain that in each issue there will be sufficient material to inspire thought processes and to encourage intelligent and reasoned thinking.

As an additional point, all monies contributed to the Foundation are deductible from your Income Tax.

The New Look

With this issue, readers of *The Air Power Historian* may note some of the results of the labors of the Editorial Board and Directors of the Foundation, who humbly hope to make further improvements with each issue. The Editorial Board has issued a standing invitation for the contribution of suitable articles dealing with the evolution of air power. It is our desire to have more and varied articles. Historical footnotes, colorful anecdotes, or considered views contrary to published historical opinions are invited. *The Air Power Historian* exists to document the historical annals of air power. All too often the truth behind the history-making events goes unnoticed or hidden by the facts themselves. The flaws in historical endeavors all too often remain camouflaged and unexposed, prohibiting the student of history from learning from the study of the past. Because of these facts, no reader should hesitate to make a contribution.

Military History—Pro and Con

At the joint session of the American Military Institute and the American Historical Association on 30 December 1956, at St. Louis, Missouri, papers were read and discussions were held on the subject: "Military History—Pro and Con." Among the papers read were: "The Case for Military History and Research" by Professor Tyson Wilson of V.M.I. and "A Civilian Caveat," by Professor A. A. Ekirch of the American University. Dr. Louis Morton of the U. S. Army Office of Military History and Professor W. T. Hagan of North Texas State Teachers College served as commentators. The Chairman of the session was Professor Richard C. Brown of Buffalo University.

Collier Trophy Award

William M. Allen, president of the Boeing Airplane Company, and General Nathan F. Twining, USAF Chief of Staff, were recently presented with the Collier Trophy award on behalf of their organizations. Boeing Airplane Company was cited for its development of the B-52 Stratofortress, and the Air Force was cited for making this bomber operational during the year 1955.

The Wright Brothers Memorial Trophy

The National Aeronautic Association recently awarded The Wright Brothers Memorial Trophy for 1956 to Dr. Edward P. Warner, president of the Council of the International Civil Air Organization, for his generous public service to the cause of aviation since 1917.

Operation Powerhouse—Another Milestone

For a two-week period ending December 11, 1956, more than one thousand B-47 jet bombers of the Strategic Air Command flew nonstop combat training missions averaging 8,000 miles each, over North America and the Arctic. According to General Twining in his speech at Denver, this operational exercise was planned and implemented as part of SAC's striking power. General Twining said: "The nation's Strategic Air Force has tested the operational capability of its strike force in such large numbers and during such a short period of time. These missions demonstrated our capability to launch a retaliatory strike force in minimum time."

RECOMMENDED READING

Recent Books

Martin Caidin, *Zero* (E. P. Dutton & Co., $3.00). The Pacific Air War as told by two former Japanese Naval Air officers.

Mae Mills Link and Hubert A. Coleman, *Medical Support of the Army Air Forces in World War II*, G.P.O., $7.

Vice Adm. C. A. Lockwood, USN (Ret.) and Col H. A. Adamson, USAF (Ret.), *Zoomies, Subs and Zeroes* (Greenberg Publisher, $3.95). Rescues of U.S. airmen in the Pacific theater in World War II.

Harold Mansfield, *Vision: Saga of the Sky*, (Duell, Sloan and Pearce). The historical story of the Boeing Company and its aircraft.

Colonel Barney Oldfield, USAF, *Never a Shot in Anger* (Duell, Sloan and Pearce). Inside historical account of press and radio coverage during World War II.

Charles A. Pearce (Ed.), *Right Down the Line: A Book About Leadership* (Arrowhead Books, $2.50). Cartoon and caption book on air leadership.

Marshal Sir John Slessor, RAF (Ret.), *The Central Blue* (Frederick C. Praeger). An autobiography.

Maxwell A. Smith, *Knight of the Air* (Pageant Press, $4.00). Biography of the famous French literary airman, Antoine de Saint-Exupery.

A. C. Spectorsky (Ed.), *The Book of the Sky* (Appleton - Century - Crofts, $10). An anthology of writings and photographs on all aspects of the conquest of space.

R. E. Stockwell, *Soviet Air Power* (Pageant Press, $7.50). Comprehensive review.

Recent Articles

W. T. Bonney, "The Heritage of Kitty Hawk," *Pegasus*, Summer 1956.

Robert T. Finney, "Early Air Corps Training and Tactics," *Military Affairs*, Fall 1956. Covers the years 1907-1921.

Lt. Gen. Sir Ian Jacob, "The High Level Conduct and Direction of World War II," *The Royal United Service Institution Journal*, August 1956.

Gen. L. S. Kuter, USAF, "An Air Perspective in the Jetomic Age," *Air University Quarterly Review*, Spring 1956. A historical review.

Ed Mack Miller, "Raoul Lufbery: Man of Mystery," *Air Force*, January 1957. An account of the exploits of the famous ace.

Lt. Col. Clarke Newton, "The Man Who Gave Us a SAC-full of Fighters," *Air Force*, January 1957. Biography of the late Colonel Dave Schilling.

Col. Jack D. Nichols, USAF, "The Element of Surprise in Modern Warfare," *Air University Quarterly Review*, Summer 1956. Historical review of the blitzkrieg and Pearl Harbor in the light of the contemporary military situation.

Ben Pearse, "Hap Arnold—It's Still His Air Force," *Air Force*, August 1956.

Dr. Harry H. Ransom, "Lord Trenchard: Architect of Air Power," *Air University Quarterly Review*, Summer 1956.

Major Alexander P. de Seversky, "The Importance of Global Command of the Air," *Vital Speeches*, November 1, 1956.

Brig. Gen. Dale O. Smith, USAF, "Age of Military Innocence," *Ordnance*, May-June 1956.

Dr. Edward Teller, "The Nature of Nuclear Warfare," *Air Force*, January 1957.

Gen. Nathan F. Twining, USAF, Text of Statement to the Senate Armed Services Committee on Visit to Russia from 23 June to 1 July 1956, 10 July 1956, *Army-Navy-Air Force Journal*, July 14, 1956.

E. L. Williams, Jr., "Legislative History of the [U.S.] Air Arm," *Military Affairs*, Summer 1956.

Charles E. Wilson, "Clarification of Roles and Missions to Improve the Effectiveness of Operation of the Department of Defense," *New York Times*, November 27, 1956. Reprint of official memorandum.